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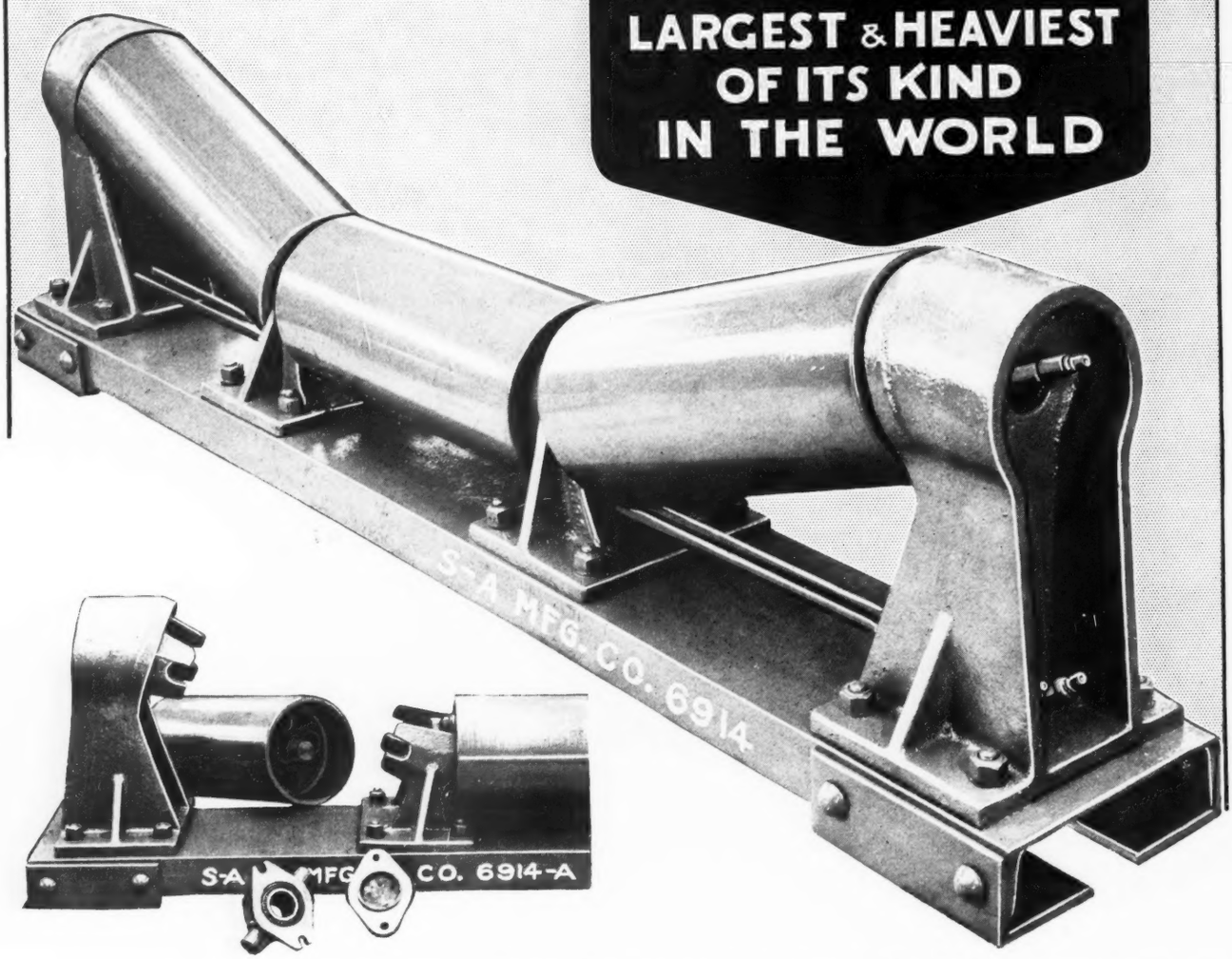


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*Volume* 123 New York, March 5, 1927 *Number* 10

ENGINEERING AND
# MINING JOURNAL

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Tenth Ave. at 36th St., New York, N. Y.
883 Mission St., San Francisco, Calif. Colorado Building, Washington, D. C.

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Cable Address: "Machinist, N. Y."
Copyright 1927
By McGraw-Hill Publishing Company, Inc.
Publishers of
Engineering News-Record American Machinist
Power Chemical and Metallurgical Engineering
Coal Age Engineering and Mining Journal
Ingeniería Internacional
Electrical World Electrical Merchandising
Bus Transportation Electric Railway Journal
Industrial Engineer Radio Retailing
Successful Construction Methods
Electrical West
(Published in San Francisco)
American Machinist—European Edition
(Published in London)

The annual subscription rate in the United States, Canada, Mexico, Alaska, Hawaii, Philippines, Porto Rico, Canal Zone, Honduras, Cuba, Nicaragua, Peru, Colombia, Bolivia, Dominican Republic, Panama, El Salvador, Argentina, Brazil, Spain, Uruguay, Costa Rica, Ecuador, Guatemala, Chili, Haiti and Paraguay, $5 per year. Extra foreign postage, $3 (total $8 or 34 shillings). Single copy, 25c. Change of Address—When change of address is ordered the new and the old address must be given. Notice must be received at New York at least ten days before the change takes place. Published weekly. Entered as second-class matter June 20, 1879, at the Post Office at New York N. Y., under the Act of March 3, 1879.
Printed in U. S. A.
Member Audit Bureau of Circulations.
Member Associated Business Papers, Inc.

11,928 COPIES PRINTED THIS ISSUE

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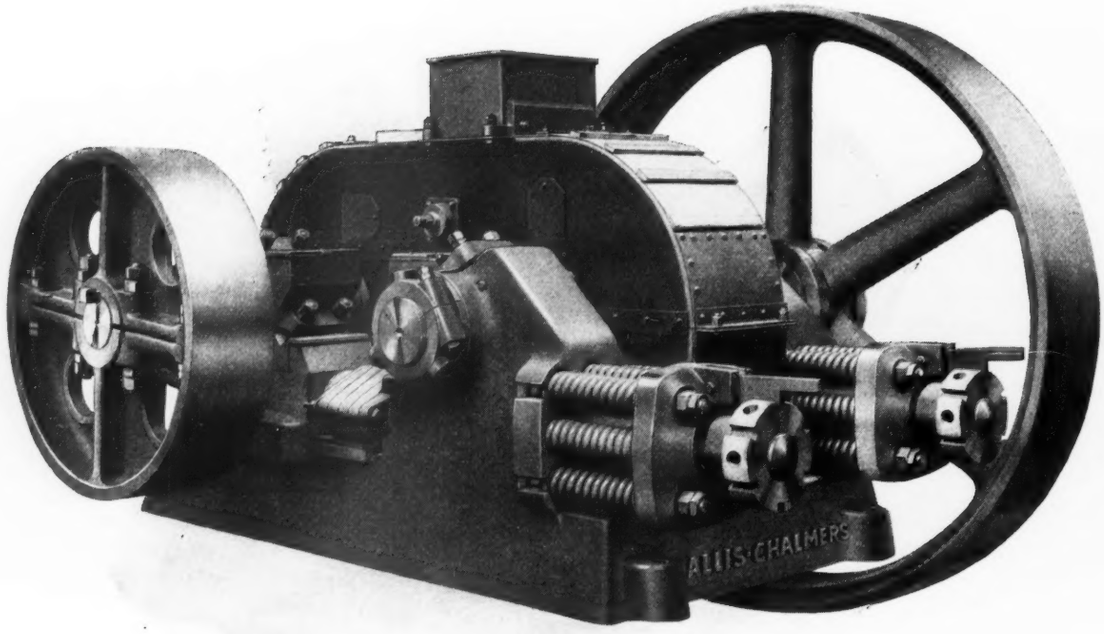


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ENGINEERING AND
MINING JOURNAL

JOSIAH EDWARD SPURR, Editor

*Volume* 123 | New York, March 5, 1927 | *Number* 10

## The Future of Bauxite

ALUMINUM MANUFACTURE is one of the youngest of the metal industries, but it has made remarkable progress in the few years since metallic aluminum was regarded as a curiosity. The chief ore is bauxite, and to meet the growing demand for metallic aluminum, ore production has increased by leaps and bounds. From a total production of 728 tons in 1889 it reached a maximum of 522,690 tons in 1923. During the last ten years the demand for bauxite has been further increased by its rapidly growing application to the manufacture of products other than metallic aluminum. Refractories, artificial abrasives, aluminum chemicals, and, more recently, high-alumina cements have made increasing demands on bauxite. New uses are constantly springing up; for example inquiries have recently been made for supplies of bauxite low in silica to be added to furnace burdens in order to increase the aluminum content of slags.

With constantly increasing requirements for the well-known uses, and with new uses appearing, the demands upon domestic deposits have been excessive. Bauxite users are viewing with some apprehension the gradual depletion of the high-grade ores, for the high-grade deposits alone are exploited, little or no attempt having yet been made in a commercial way to develop any process of concentration.

That the orebodies now worked are inadequate to meet present needs is reflected in the great increase in importations of foreign bauxites. Imports in 1925 exceeded 350,000 tons—almost double the amount recorded for 1924, and for the first time exceeded domestic production, though in 1926 imports declined to 281,000 tons. As the largest producers are also consumers, there is little prospect of any restraining tariff.

What are the future prospects for American bauxites? Even in the face of large importations several factors point toward a more extensive utilization of domestic ores. New deposits of high-grade ore are being uncovered, and undoubtedly others will be found, but it is unlikely that such developments will keep pace with the demand. One of the most interesting recent movements is toward concentration. Large bodies of low-grade bauxites exist in several Southern states, bauxites of a grade that cannot be employed in modern methods of manufacture. Diaspore clays are also known to exist in extensive deposits, particularly in central Pennsylvania, but little effort has been made to utilize them as substitutes for bauxite. Both the U. S. Bureau of Mines and private companies are giving attention to possible methods of reducing the percentage of silica, alumina, iron, and titanium in low-grade bauxites, and thus raising the grade to a commercial standard. This is a difficult problem, and with many ores probably impracticable. The intimate association with clay, and the slight difference in specific gravity between the impurities and the bauxite, are factors that discourage gravity concentration.

The difficulty of applying ordinary ore-dressing methods to low-grade aluminum ores has suggested the possibility of an entirely new metallurgy, the development of processes of obtaining aluminum whereby the impurities may present a much less serious problem than that encountered by the aluminum metallurgist of today. Electrothermic methods have been suggested, and rumors of other processes of treatment have been heard. The electrolysis of aluminum sulphide is said to have distinct advantages over the present oxide process, but it has not been developed commercially. With the growing demands for bauxite, the uncovering of larger and larger orebodies of various types, and the evident desire to find some profitable means of utilizing low-grade ores, interesting developments both in ore dressing and subsequent metallurgy are to be expected.

## A Wonderful Opportunity to See Canada's Mining Industries

THE SECOND Empire Mining and Metallurgical Congress, to be held in Canada this summer, will apparently dwarf all the conventions and tours in which mining engineers have so far participated. Over 400 men and over 200 women have already signified their intention to attend, more than half of whom are from Europe, Asia, Africa, and Australasia. It is expected that the total attendance will be close to 1,000, which will necessitate five or more special trains on which the party will make its home in the six weeks' tour across the country. It is expected that costs will be approximately $500, including everything that sober people will require after their arrival in Montreal. There is little doubt that every one will get his money's worth. The opportunity to see the mining industries of this rapidly growing country is unparalleled, as is also the privilege of meeting and knowing mining engineers from all over the world. Mining men in the United States will no doubt attend in large numbers.

Two tours are planned, following the technical sessions to be held in Montreal in the middle of August. One will leave Montreal on Aug. 23, visiting the important mining districts all the way to the Pacific Coast, returning to Montreal on Sept. 28. The other party, after seeing what Ontario and Quebec have to offer, will turn eastward, visiting Nova Scotia and Newfoundland and their iron and coal districts, and returning to Montreal on Sept. 16.

## Prohibition

IN A WORLD where so much of the current talk is about alcohol, editorial pages that do not deal with the subject are unusual. It is a question which affects industry directly and indirectly; and the hullabaloo about it has become so great that it is difficult to ignore it. The evils of alcohol are unanimously acknowledged. The benefits of prohibition so far seem

to have been that it blocked the free access to alcoholic drinks by large classes of working men, with consequent benefit to themselves and their families and industry at large. The great injury it has wrought lies in the fact that the law has not been enforceable even to a reasonable degree, so that anyone who really cares for alcoholic drinks can get them with little or no greater trouble than formerly—only at a somewhat higher price. It is now clear that the law will not be enforced. It is broken, or the breaking of it is observed and ignored, by senators, governors, judges, and ministers of the Gospel, along with everybody else. It has made whisky popular and fashionable, hip flasks a national institution, and has revived the decadent art of home-brewing.

At the root of the whole matter seems to be the disinclination of the people to be dictated to on matters concerning which they believe they have an individual right to regulate themselves. Certainly to incorporate such a rigid repression in the Constitution was encroaching far upon personal choice; and the methods of trying (vainly) to enforce it by the use of spies, crooks, and *agents provocateurs* have discourage all classes. The final outcome is not yet. The greatest triumph apparently that can be obtained would be to have it sink gradually into the list of laws which are enforced only on occasion—and in which our codes abound. The experiment will perhaps check the tendency to amend our Constitution so as to revive thereby the Puritanical conception of enforced conduct. The child labor law was defeated because the people were tired of tinkering at the Constitution, and because they are reacting, even if vainly, toward greater state autonomy, civic liberties, and individual freedom. There is now a movement to impose the religion called "fundamental Christianity," by the enactment of state laws or even by a constitutional amendment. It would be far better, if laws restrictive of personal activity are to be made part of the Constitution, that we should never have had a Constitution. England has gotten along very well without one.

## New York State Sovereignty Over Mines

AN INVESTIGATOR, writing to the *New York Times*, digs up the following excerpt from the mining laws of New York State:

"In part, Section 80 of the Public Lands law of New York provides as follows:

" 'The following mines are the property of the people of this state in their right of sovereignty:

" '1. All mines of gold and silver discovered, or hereafter to be discovered, within this state.

" '2. All mines of other metals, and of talc, mica or graphite, discovered, or hereafter to be discovered, upon any lands owned by persons not being citizens of the United States.' "

He observes that gold mines in New York have not been of sufficient importance to raise questions of state sovereignty, but that if one should be encountered it might stress the fact that the state has ownership; and that if a rich mine of some other metal were discovered upon a property belonging to an alien, an international situation might arise. He adds, "If the owner of the land happened to be a British subject, the matter might be treated more seriously than if it belonged to a citizen of Mexico."

It all depends upon whose ox is gored; also whether the ox is worth enough to go to law about. In Mexico the petroleum fields are of sufficient importance to warrant lavish expenditures, bribery, diplomacy, propaganda, and abstruse arguments: just as the petroleum fields in the United States and in foreign countries besides Mexico have inspired similar efforts. Abstract right and wrong are colored by many other and weighty considerations.

## Electrification of Mines on the Mother Lode

THE LAST important steam hoist upon the Mother Lode of California was supplanted by an electrically operated hoist late in 1926. This was at the Kennedy mine, near Jackson, Calif. The main working shaft at this mine is vertical and now at a depth of about 4,600 ft., the lowest mine level being 4,500 ft. in depth. The new hoisting arrangements are designed to serve a depth of 5,000 ft. Electrification of mines on the Mother Lode has been progressive. The prevailing economic conditions made it necessary for all gold mines to modernize their plants thoroughly, but these likewise prevented a speedy change, for capital was hard to get. The gold mines have gradually effected changes in both operation and equipment and are now in a much better position than at any time since the war.

## Nevada Proposes New Tax Legislation

NEVADA'S net proceeds tax law for mines defines net proceeds as gross yield less actual cost of extraction, treatment, transportation, and sale. Net proceeds are assessed and taxed on an ad valorem basis, like other property. The law as it stands has been the subject of controversy between mining companies and assessors. Courts have sustained the letter of the law, and mining companies have failed to secure plant-depreciation allowances, and deduction for construction, contemporaneous development, and cost of insurance of several kinds.

In the present session of the Nevada Legislature a bill introduced by Senator John H. Miller, of Mineral County, is under consideration which more equitably defines "net proceeds" and provides additional deductions such as actual cost of construction, repairs, and betterments in both mining and milling plants and for transportation; actual cost of fire and industrial insurance and supplemental expenses; depreciation at the rate of not less than 6 per cent nor more than 10 per cent per annum upon the assessed valuation of machinery equipment and other plant facilities; and, in addition, the actual cost of contemporaneous development work. The bill would also place responsibility for determination of net proceeds upon the Nevada Tax Commission.

The proposed law has two important advantages; it defines more fully net proceeds and removes the adjudication of this special tax from county officials. Assessment of property holdings of a mining company will, however, remain unchanged.

Assessment of net proceeds is undoubtedly the simplest basis upon which to tax mineral deposits, as net proceeds represent a specific part of the value of a deposit returned annually to the owners. Other methods of valuation involve assumptions as to probable metal-selling prices, dollar values, and wages; and, in addition, presume that more or less information as to the size of the deposit is available. Present worth is arrived at by assuming a given rate of return, and therefore

represents only a hypothetical valuation, subject to the uncertainties of economic conditions. Annual surplus over expenditures is a specific sum and readily ascertained.

## Electrical Ore-Finding

WHILE GREAT INTEREST has been developed in electrical ore-finding devices, and they are being tried out in many camps in different countries, it still remains to evaluate their actual scope of usefulness. Such methods are recognized as of enormous possible application in places like the glacial drift-covered regions of Canada, and they have accordingly been used largely in prospecting the country around Rouyn, in Quebec. It is reported that the first drill hole in this district, driven to test a location indicated by the electrical instruments to be favorable, failed to find the expected sulphide body, with the result of a general reaction in the price of prospects. One swallow does not make a summer, either way. There are well-established cases of sulphide orebodies discovered by these devices; other types of orebodies, such as gold-quartz ores, have not, so far as known, been so discovered. Therefore the instruments have seemed applicable to such a problem as that of the Rouyn district, whereas they would probably not be employed in a district like Porcupine.

Altogether, mines are discovered in many ways, of which electrical ore-finding is one. Only the experience of the future will determine whether the mechanical methods will be revolutionary, or whether they will score only an occasional success as opposed to a good deal of certain expense.

## Zoological vs. Geological Decoration

FROM a friend and supporter, very influential, and therefore one whom we would not like to offend by refusing, we receive the following, offered for publication:

"Next to decorating a club or hotel room with oil portraits of common and unknown celebrities, comes in favor the picture of having various heads of defunct animals, stuffed and lifelike, sticking out of dark wainscoating on all sides, as cows stick their heads out between their stanchions in the barn. The instinct for this type of decoration probably goes back to the primitive step of existence—not so far back perhaps in our own ancestry, when our forefathers lived in a one-room shelter, or under a single roof without walls, together with the domestic animals—the cow, the pig, the dog, and the chickens. One may experience the same thing nowadays in many parts of the world, and—as in Cuba—have to share one's sleeping quarters with a whole menagerie of domestic animals, and find the pig reposing and at home under the dining table. Some men have outgrown the taste for this life and also the longing for the heads of animals sticking out of the walls in the byre; and for such, naturally, the animal-head style of decoration is not pleasing. But if such a one had to choose, he would prefer the heads of the good old animals so protruding—the common or garden cows, the reliable old hosses, the plain sheep and pigs. In entering such a room, one would croon softly 'Locked in the stable with the sheep, now I lay me, etc.'

"Instead of which, the world is ransacked for grotesque varieties. The sheep, the cows, are there, but oh, how changed! It seems impossible that by flattening the head here and elongating it there, by screwing the eyes around and curving the horns this way and that, le bon Dieu has been able to make such a variety of cows and sheep and the like, and all with different names. It is an honor, it seems, to shoot one of these caricatures and bring it home: and it is to be assumed that its distorted countenance is considered by some as a decoration. Of all the nightmarish swine, commend me to the wart hog, for example. And why give corkscrews for horns to a deer—and call it on top of that the Greater Badu? And finally comes the rhinoceros head, belonging to a creature I have never met in the woods—and, please God, I never will. And next to that, perhaps, is a sort of deer or something, labelled 'Hartebeeste'; it may be—he looks it. And so on. Cannot something be done about all this in the interests of truth and beauty?"

We fail to see what this has to do with the mining industry; aside from which there are a number of arguments which might be offered in support of the zoological dado scheme of embellishment. But if mining men would use their influence to have beautiful crystals and glittering geodes worked into ornamentation, producing the geological instead of the zoological motif, it would help out beauty and educate the other fellow in the glamour of the underground—and incidentally keep alive in our clubs, the haunts of moneyed men, the interest in mining; and so make it easier to swing a deal.

## Manufacturing Silver From Lead

IT IS ALLEGED in a recent newspaper article that a silver "mine engineer," in co-operation with an electrical expert and a policeman, have effected the transformation of lead into silver by a chemical process and the application of strong electrical currents. More, the cost of production is said to be very slight. And yet more, the little article says that a contract has been signed for a factory and electric equipment with a capacity of two tons of silver per day!

First it was the gold "makers," who had a long and not an especially edifying history. And now it is the white and pure metal, silver, that is to be degraded into brutal manufacture from the base but very useful metal, lead. "Science is wonderful," says Sandy McWilliams, but scientists have missed something by overlooking the valuable results obtainable by enlisting the combination of "silver mine engineer," electrical expert, and policeman. That is a rare combination and might well be a good lead for an exhilarating short story.

The report of the Indian Currency Commission crimped silver prices seriously until the hard sense of both silver buyers and silver producers restored equilibrium and started the price of silver back toward a fairer basis. This little "news" item about cheap synthetic silver, on the other hand, will not disturb the silver market.

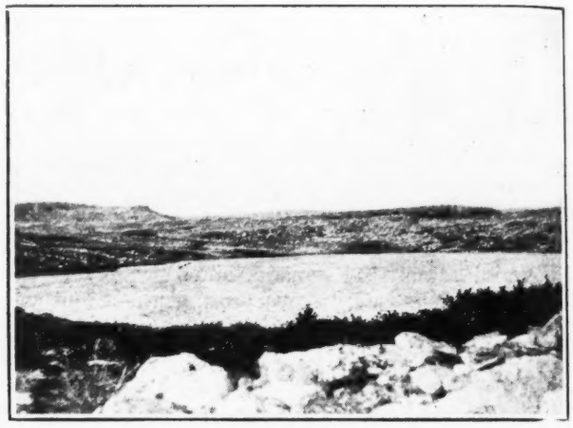
## Julian Merger Mines, Inc.

WHEN THE SALE of Western Lead was banned by the California State Corporation Commissioner, the Death Valley prospects controlled by C. C. Julian were reincorporated, along with mining claims in Arizona and, it is said, with certain property in Canada, as the Julian Merger Mines, Inc., the incorporation of which was made in the District of Columbia. Another effort was made to sell the stock of the new incorporation in California. The Corporation Commissioner promptly stopped sales, and a test case established the right of California to control the sale of securities within its borders. Apparently no effort was made to take out the necessary permit to sell stock.

Repeated attempts to evade the California Securities Act have been made by resort to technicalities. However, the clear intent of the law has been sustained by the courts, as in this last instance.

# Newfoundland Through the Camera

*Mill at Silver Cliff lead and zinc mine*



*In the interior. Hickey's Pond iron formation*

*Wabana—"Where the light first shines"*

*Woodie Island—A typical outpost settlement*

*Placentia—"The town of rolling stones"*

# Newfoundland—Its Resources

*A Well-Mineralized Country, Where the Government Seeks to Foster Mining*

By Dwight E. Woodbridge
Mining Engineer, Sellwood Building, Duluth, Minn.

THE ISLAND OF NEWFOUNDLAND has an area of about 42,000 square miles and a population of some 260,000. It has three main industries, fishing, paper and pulp making, and the mining of iron ore at Bell Island. All other industries are subordinate to these. The gross returns from fishing for 1926 will approximate $14,000,000 and a million tons of iron ore will probably be shipped. Paper produced is chiefly for the Harmsworth enterprises in England. The government owns its transportation lines across and around the island and a large drydock at St. Johns, and receives an income from Atlantic cables which come to land on its shores. About half the Labrador territory is claimed by Newfoundland and has been administered by the St. Johns government; but negotiations are now in progress in London for the sale of this land to Canada. Though the price to be paid is not yet agreed on, it will run well into the millions of dollars. If these negotiations are carried out, all Labrador will become a part of Quebec, and the claim is that it may be administered more efficiently from Montreal than from St. Johns.

Newfoundland's banks have been frequented for 400 years by multitudes of fishermen. There have been the hardy men from that island, and equally courageous seafarers from the adjacent French territory of Miquelon, from Labrador, from Nova Scotia and the United States, and from Brittany, Portugal, and Spain. Apparently in all this time there has been no great nor progressive diminution in the supply of fish. The sea has proved itself inexhaustible. Fluctuating years and cycles there are, but the industry recovers. In all this time there has never been a comprehensive biological study of the cod and his habits. This year's catch by Newfoundland fishermen alone will approximate two million quintals (a quintal is 112 lb. of prepared cod). No other fishing ground, not excepting that off the coast of Norway, approaches these banks in total catch. The great market for Newfoundland cod is in Latin countries, states whose currencies are more or less depreciated, so the business is not particularly lucrative and the fishermen nowadays face a difficult situation.

Lines of steamers carry the better fish to Spain; other grades go to Italy, Portugal, and Brazil. The poorest qualities find their market in the Barbadoes. Cod caught by the fishermen of the islands of Miquelon naturally go to France. The United States is supplied by men from Gloucester and Maine; Canada by Nova Scotians.

### Diversification of Industries Sought

In view of the poor return from fishing, the government is attempting to foster other industries, especially that of mining. It has guaranteed private investments in the paper business, and to aid tourist traffic, and probably would assist in any reasonable manner legitimate efforts toward the developments of its minerals. It is alive to the possibilities of the sportsmen-tourist trade and is about to issue a series of motion-picture films, illustrating the very decided charms of the island for sportsmen. These will show the rivers and lakes populated by salmon and trout, the highlands inhabited by caribou, deer, and ptarmigan. They will present an alluring picture. It has co-operated in the erection at St. Johns of a fine modern hotel and in constructing some excellent highways in localities notable for the scenic attractiveness.

As yet its good roads are few. There is a majestic drive from St. Johns around the shore of Conception Bay to Harbour Grace, that is now being extended toward the tip of the Avalon Peninsula. In the course of a rather wide experience over the world I have yet to see a more interesting highway. Another road leads through forests across the peninsula of the old French capital, Placentia, an aged town built on rolling stones at the edge of the sea. The system is being extended and in time may reach as far as the southwest corner of the island, where the steamers from North Sydney touch the coast. Material of which these roads are built is excellent for the purpose, and permits wearable surfaces without excessive cost.

No direct taxes are levied by government, and the people are happy in the notion that they are tax-free. But the delightful irony of some tariffs is splendidly exemplified in Newfoundland by import duties, indirect taxes. Part of these are for primarily, part protective; and the fishing industry, arduous, dangerous, and rather unremunerative at best, suffers from them an additional hardship.

### Pre-Cambrian, Silurian, and Carboniferous Rocks

The island consists chiefly of great masses of Pre-Cambrian rocks, with their major foldings north and south — twisted, contorted, intruded, and metamorphosed. There are large areas of Silurian sediments, and the most recent rock system is Carboniferous. Newfoundland's coast line is a series of bays within bays and is irregular in the extreme. The limits north and south and east and west are about 300 miles, but so many and deep are the jagged irregularities that the coast is at least 2,500 miles long. The interior is largely swamps, barrens on which berries grow in profusion, timbered areas, and bare rock exposures. The island was discovered by Cabot in 1497, but, old as it is, much of this interior never has been prospected.

Comparatively few people live away from the coast. Except for the towns of St. Johns and Grand Falls and the mining centers of Bell Island and Port au Port Bay, the population is scattered among the outports along the rugged coast, engaged in fishing. Agriculture is a minor occupation, for the winters are long and the summer nights are chill. In the springtime icebergs,

floating south with the Arctic current, move in stately procession down the coast and sometimes can be counted by hundreds off St. Johns. Potatoes, cabbage, roots, and wool are the chief products of the little farmsteads, in a soil reclaimed from the drift-covered areas inher-

*Outcrop of Dominion iron ore bed on Bell Island*

ited from glacial ages. The people import from Canada even many of the farm products that might be produced at home.

The geological conditions of the island are favorable for the presence of minerals, and indications of various ores are to be seen in widely separated localities. One common definition of a Newfoundlander is "a man with a mine in his backyard." But the people do little to develop these resources. Indeed, they cannot; most of them are poor, and mining is out of their line; the country has been out of the trend of mineral development in North America, the successive waves of which have been westerly, though a reaction now is evident; and they are obsessed by the usual exaggerated ideas of the values of their stringers and lodes whenever outsiders suggest negotiations with regard to them.

### Iron Ore on Bell Island

Bell Island's vast deposits of phosphoric iron ore are well known. These beds have been given the name of Wabana, meaning "the place where the light first shines." This definition is literal, for these mines are situated on the most easterly land in North America. They are in Conception Bay, which was named by Cartereal, who followed the Cabots as a discoverer of this coast. These beds contain perhaps the greatest deposit of merchantable iron ore in existence, aside from those of the Minas Geraes regions in Brazil. Their grade is average. Up to the time of the formation of the British Empire Steel Corporation, in 1920, by far the greater bulk of this vast tonnage was held by the Nova Scotia Steel & Coal Co. This was a well-rounded, self-contained, successful and profitable mining, steel-making, transportation, and manufacturing concern, employing six to seven thousand persons, chiefly in Nova Scotia.

A lesser portion of Wabana was held by the Dominion Steel Corporation through a subsidiary organization. Its steel-making capacity is much greater than that of Scotia; nevertheless, it has abundant ore for a hundred years and more. It operates large limestone quarries on the west coast of Newfoundland and extensive submarine coal mines near Sydney.

By the formation of "Besco," so called in Canada, these two companies, together with several more or less related industrial organizations, were merged. Later the outside concerns that had been taken in were sloughed away, and the original capitalization of Besco was reduced. This corporation has not been as profitable a venture as was hoped; it is stocked for $90,000,000 in common and preference shares and there are outstanding some $37,682,000 in bonds and debenture stocks of the two underlying companies. Its physical assets consist entirely of the properties of the Scotia and Dominion companies. On its common and second preference stocks no dividends have been paid, and on its first preference none since February, 1924. Dominion has gone into the hands of a receiver, and an effort is being made to have Scotia follow the same step toward ultimate reorganization. Iron and steel conditions in Canada during the past few years have not borne out the hopes of this ambitious corporation and its promoters.

### Much Iron Ore in Independent Hands

Not all the ore of the Wabana beds lying off Bell Island belongs to the two companies mentioned. An astonishingly large tonnage remains in outside hands. When one realizes that these beds contain perhaps four billion tons and cover an area of many square miles, the fact that it is not all in one holding is not surprising. That the British Empire company controls so much iron ore is the remarkable fact.

These ores average about 50 per cent iron and 0.8 per cent phosphorus; they are dust-free and comparatively moisture-free, and break readily into rhombohedral blocks of sizes satisfactory to furnace men. Mining is now conducted at points nearly two miles out from shore, and there the main bed is some 30 ft. thick. It stands solidly under the weight of a quarter of a mile of rocks and ocean, and the faces present the appearance of black basaltic columns compressed into a continuous wall. It is probable that this can be delivered along the north Atlantic Coast at a cost of about 7c. a unit of iron. One would think there might be a wider outside market for this ore than now exists. Some goes to Germany and a little to the United States. The steel makers of the United Kingdom would have to change their practice somewhat to draw on this vast reserve in their own empire, and so they do not use it.

Newfoundland contains many evidences of additional iron-ore deposits. Indeed, Wabana itself is proof that such deposits existed formerly, at any rate, for the theory is that the iron of this deposit was derived originally from weathering of earlier crystalline and sedimentary rocks, the solution of their iron content, and its transportation by streams into the sea, there to be bedded and uplifted, and subsequently eroded to the present outcroppings along Bell Island. At various places on the Avalon Peninsula rich hematites are found, of types associated with Pre-Cambrian rocks, far older than Wabana. Some of these show a marked

similarity to better ores of the Lake Superior region. Assays up to 62 and 63 per cent are not uncommon, and the texture of the ores is good. At some of these places work was done many years ago, but now all the old openings are broken down and full of water. None of these explorations ever reached the state of development where shipments were made from them.

On the west coast of Newfoundland near Point au Basques is Steel Mountain, a deposit of titaniferous magnetite, very large but of no immediate importance. I have not seen it, but from reports that are made I take it to be an enormous magmatic segregation, like some north of Lake Superior, eroded and exposed. There are authenticated reports of iron ores in other parts of the island, especially of magnetites in Notre Dame Bay.

### Copper Mining Once Important

It will be a surprise to many in the copper fraternity in the United States to learn that forty years ago Newfoundland ranked sixth in world's production of copper. But for a generation most of its copper mines have been idle. The last was Tilt Cove mine, and it closed ten years ago. These cessations were due to the exhaustion of high-grade ores in the mines along the copper belt of Notre Dame Bay, to troubles with water, to price recessions, and to the failure of those owning these lands to acquaint themselves with the technical advance of methods of ore beneficiation. In the old days ore was sent to Swansea for smelting, or went in the form of regulus for refining, and only the richer of these yellow ores was utilized. Ore was hand-sorted for shipment, and there remain large dumps of leaner chalcopyrite. Possibly much of the rock in these dumps might now be treated at a profit.

In addition to these dumps, several of the old mines show a tonnage of ore in place, minable by open-cut methods, lying at sea level, and running somewhere above 2 per cent copper in the form of sulphides. As usual, all sorts of rumors are current as to what remains underground; some very optimistic, others quite the opposite. It is strange how different the same set of facts reacts upon diverse habits of thought and more or less accurate memories.

Two years ago copper deposits under Great Gull Lake were drilled, and the work disclosed some two million tons of copper sulphides assaying better than 2.5 per cent copper. One hole showed a width of lode of nearly 100 ft. Some beds of native copper occur, especially in the Bay of Islands and on Odiron Island, Placentia Bay. These seem unimportant.

The possibilities of Newfoundland in copper are among the old mines of Notre Dame Bay, and it is hard to believe that all the good ores that existed in these deposits have gone to Wales. One of these old mines was 1,400 ft. deep, and their production was as high as 90,000 tons of ore a year.

*Another outcrop of iron ore on Bell Island. Note the dip and the fracture of the ore*

The American Smelting & Refining Co. has been at work for some time investigating complex ores in the interior of the island, using geophysical apparatus in its search. It is said to be satisfied of the presence of a large tonnage of commercial ore, carrying zinc, cop-

per, lead, silver, and gold, and it is reported that intensive development will soon begin. Initiation of mining work by such a concern as this will do much to call attention to the mineral possibilities of the island in general and to encourage others to follow. For this reason, and because of other considerations, the government of the island is watching the progress of this affair with the deepest concern.

### Placentia Bay Chief Lead Area

The chief lead area of the island is in Placentia Bay. La Manche mine was discovered by those who searched for a landing for the first Atlantic cable above its outcrop, and it was worked for years by a company associated with that enterprise. The returns from this mine are said to have been of material aid in financing the completion of the Cyrus W. Field cable in 1858. For many years and until last summer it had been idle. Now it is under exploitation by people of ability. The ore occurs in a calcite vein 3 or 4 ft. wide that is visible under the sea and runs inland for some miles. It carries a thick pay seam of galena and the calcite filling is more or less impregnated with the same ore. Former work was in the pay seams alone and the leaner material was hand cobbed for what it would yield. There is much minable ground below and even beyond the old work.

A few miles away is another lead mine, Silver Cliff. Its ore carried both lead and zinc, and a small concentrator was used to the time of closing. This took place when the vein faulted and there was not money with which to search further. Trinity Bay shows a galena vein that has been prospected within a few years. At Placentia are a few old openings.

### Chrome Ore Once Mined—Gold

Chromite was discovered in 1894 and was mined then and during the war. It is found at Port au Port Bay and Bay of Islands, on the west coast. The country rock is diorite traversed by serpentine. Sorted chromium oxide assayed about 50 per cent in shipments that were made, and a concentrating works would have been constructed if the war had continued longer.

Gold exists in several localities around White Bay, and some of the copper ores carry this precious metal in paying quantities. Tilt Cove mine, for example, produced $1,000,000 in gold during its life as a copper mine.

### Limestone, Feldspar and Mica Found

Non-metallics which occur in minable tonnages and available localities—that is, on the sea—include asbestos, feldspar, gypsum, limestone, marls, mica, talc, and some others. Blast furnaces at North Sydney receive much of their flux from limestone quarries on the southwest corner of the island, and a very large supply exists there. Next to Wabana this is the chief mineral activity today in Newfoundland. Near Hardy harbor is a deposit of feldspar and mica in which a million tons is said to be in sight, close to deep water. This matter of adjacency to water transportation will some time be recognized as of extreme importance in connection with mineral deposits of this island, particularly with respect to minerals of low unit value. Between the hamlets of Hearts Desire and Hearts Content, on Trinity Bay, are beds of reddish and brown limestone suitable for the manufacture of cement. These deposits are directly on the sea, cheap power is convenient, and freight rates to American ports are such as to make these beds of probably high commercial value. There are small coal areas and some oil shales on the west coast. A little oil is being pumped.

Undeveloped water-powers are many; they are scattered throughout the island. In many cases they can be harnessed at comparatively small cost. Fishing villages are supplied with light by local plants, and in the neighborhood of St. Johns there are power developments of importance which are now being expanded.

### Romance of Newfoundland's Shores

Newfoundland is a promising, interesting, and romantic region. Even the names of its villages and headlands appeal to the imagination; one wonders to what historic event or stirring adventure they are due. The harbor of St. Johns, where great bergs drift slowly past the entrance and where the fishing schooners come scudding in from sea, has long been the outfitting point for polar journeys. Here Peary started, and his navigator, Captain Bartlett, still lives at Brigus. Here, also, almost continually for long and bitter years, ownership of the land was argued by the arbitrament of war between Briton and Gaul. Close by this shore are the shrunken remains of that far-flung empire France had in the new world when the Pompadour flourished at Versailles; an empire now reduced to the two little islands of Miquelon, policed by a company of soldiers and inhabited by a few thousand fisherfolk and smugglers. Off this coast have been tragedies of the sea, innumerable and sad. Here lies the "Titanic," an example of craftmanship so perfect that she was sent on her only transatlantic voyage as a ship that "neither God nor man could sink." These are the people for whom Wilfred Grenfell has devoted his life for a generation.

The land is packed with romance. Port au Basques, Hearts Desire, Spaniards Bay, Turks Cove, Harbour Grace, Irelands Eye, Come by Chance Cove, Portuguese Bay, River of Exploits—these and many more. What a wealth of history, what stories of perils by the sea, of piratical adventures, of human endeavor and trial, what echoes of far European wars, these names suggest!

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## A Large Oil-Pumping Plant

The Andian National Corporation, Ltd., of Toronto, in 1925 built a 400-mile pipe line paralleling the Magdalena River, in Colombia, South America, from the Port of Cartagena up to the oil fields. This line was of 10-in. steel pipe and had a capacity of 30,000 bbl. of crude oil per day. Twenty or more large Prescott pumps were furnished to move the oil down the river. Last summer it was decided to increase the capacity of the line to approximately 50,000 bbl., and the installation mentioned is being duplicated. Included in the equipment are eighteen horizontal triplex pumps of 30,000 bbl. capacity per day each, that require a 500-hp. Diesel engine to drive them. At the terminal station four large pumps of 60,000 bbl. daily capacity each were furnished to provide facilities for loading tank steamers.

# What Is the Future for African Copper?

## *Present High Production Costs Are Likely to Be Greatly Lowered*

By George L. Walker
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THE FUTURE PROBABLE COST of producing copper in Africa is often discussed in America. Some questions have been raised that no one can answer definitely as yet, but it is possible to supply sufficient information to enable copper-mining engineers and metallurgists to arrive at a close approximation of costs, or at least to decide whether they are likely to be high or low.

A study of its reports makes it apparent that Union Minière du Haut-Katanga's production costs have been relatively high, in view of the richness of the ores treated. They have not been nearly so high as the reports indicate, however, as the company's income has been allowed to leak quite freely into its construction account, as is invariably the case with enterprises which are highly prosperous in their early stages. The many other reasons for its relatively high production costs deserve thoughtful consideration. For instance, Katanga's rich copper ores occur in about 200 separate deposits scattered over a district more than 200 miles long and 30 to 60 miles wide. They were found on a wooded plateau in the heart of savage Africa, thousands of feet higher than the point where the Congo becomes navigable, and several hundred miles from the nearest railhead. As the natives never had leveled a road or used a wheeled vehicle of any kind, the vast amount of preparatory work which was necessary can be imagined. The ores were chiefly carbonates of copper, with some silicates and oxides, but neither pyrite to form a suitable smelting mixture nor sulphur for sulphuric acid leaching were obtainable.

Exigencies soon arose which made it essential that the production of copper should begin almost immediately. That, it is well to remember, was in 1908 to 1910, the blast-furnace period of the copper metallurgical age. Unsuited as blast furnaces were to the treatment of such ores, there seemed nothing else to be done then but to install them. The grief that ensued need not be detailed, as even a scant knowledge of metallurgy should enable one to form a comparatively accurate metal picture of it—of the difficulty and expense of getting iron ore and limestone from distant points in such a country, of the eager and never-ending prospecting and drilling of the widely scattered copper deposits in the hope of discovering fluxing ores, and of the efforts to reduce the silica content of the smelting charge by concentrating the carbonate ores in a wet gravity mill. In our present-day wisdom we may choose to sneer at what was done then by the Katanga management, but with equal grace we could curl the lip at a score of other companies that in more recent years have almost completely changed their metallurgical equipment and processes.

Despite the remote location of its property, the character of its ores, and the statement by at least one metallurgist that Katanga's 10 to 15 per cent copper ores possessed no commercial value; despite the adoption of blast furnaces and gravity concentration; and despite the fact that little if any more than one-half of the copper in the ores so far treated has been recovered, Union Minière du Haut-Katanga has produced well over a billion pounds of copper, has put ten times as much more in sight in ores averaging nearly 7 per cent, has by experimentation developed an economical process for the treatment of its ores, has financed and practically completed the erection of plants for the employment of this process, and has paid a considerable aggregate amount in dividends. And so far it has worked only ten—those convenient to the railway—of its approximately 200 ore deposits. This is a record of accomplishment at which no one can afford to sneer.

### Katanga Only the Beginning

What Union Minière has done is only the beginning of a demonstration that Central Africa is a great copper region. Union Minière is the first healthy fledgling of what will be a numerous brood. Already at a producing stage, the Bwana M'Kubwa Copper Mining Co., Ltd., is developing a second mine, the N'Kana, which is a continuously mineralized lode that may prove to be several miles long. So far it has been proved over a length of 7,740 ft. to a depth of 100 ft.; it averages 35.8 ft. wide; and the 1,409,000 tons developed above the 100-ft. level (the ore does not reach to the surface) averages 4.6 per cent copper. All such deposits in that part of Africa are being found to increase considerably in richness at a little greater depth than this. The Main Lode mine of the N'Changa Copper Mines, Ltd.—the company recently organized by Rhodesian Congo Border Concession, Ltd.—averaged 3.31 per cent on the 50-ft. level. On the 150-ft. level it had been developed at last account for 725 ft. along the strike, the ore continuing in both directions, and several crosscuts had proved the grade to average 4.72 per cent over an average width of 72 ft. (a combined length, width, and richness of ore that has rarely if ever been equaled in copper-development history), and geological conditions indicate that it may continue for a length of one and a half to three miles or more.

Other deposits also exist in Northern Rhodesia—one very similar to those described, one much larger that is lower in grade, one probably not so large that is very much richer, and several more which are now being drilled, opened by shafts, and prepared for surveying and sampling.

It is fair to assume that copper-ore tonnages are being arrived at in Africa on the same principle that they have been in the United States—that portion of a deposit carrying an economically recoverable percentage of metal being measured and reported. The porphyries, it will be remembered, were much higher in grade before the discovery that 1 per cent material would pay caused

enormous tonnages to be included in their ore reserves. A large proportion of the N'Changa and N'Kana deposits could be mined to average 6 to 8 per cent, and their tonnages undoubtedly might be greatly increased, as were those of the porphyries, at the expense of grade. The important fact is that these African deposits are inherently of high grade. They contain tremendous tonnages of ore two, three, or several times the average richness of the deposits from which the world's copper supply is at present being produced.

### Country Offers Many Favorable Conditions

Conditions in Central Africa are such—all but one—as should be favorable to low-cost copper production. The altitude is high, the climate healthful, and the country relatively level; the soil is extremely fertile, and agriculture and cattle raising are beginning to flourish, assuring low living costs. Government is stable and taxes are low. Native labor is cheap and its efficiency will advance with its wages. Timber, except that required for the largest sizes, grows almost everywhere, and good coal costs about $10 delivered at railway points. Hydro-electric power can be generated cheaply and in large supply at numerous falls on the several rivers.

Perhaps most important of all is the fact that the ores in the big copper lodes of the Rhodesias change, at depths usually of 150 to 200 ft., to chalcocite and chalcopyrite, the grade being maintained—usually being somewhat higher—and extremely little pyrite appearing. One of these lodes, which has a decidedly U-like form in cross-section, has been cut at its deepest point by a drill, and the core showed rich disseminated chalcocite ore. Here is a source of sulphuric acid with which to leach the carbonate ores. The indications are that over 80 per cent of all the ores will be amenable to flotation and that the grade of the concentrates will be high.

### High Freight Rates a Present Obstacle

The one present obstruction to low copper costs is high freight rates. For illustration, Bwana M'Kubwa pays about 2c. per short ton-mile freight on copper from its plant to Beira, a distance of 1,444 miles. This is probably over double the average ton-mile rate paid on copper in the United States. As freights are correspondingly high in Africa on coal and other supplies, and as Beira, being on the southeast coast, is about 8,000 miles by water from western European ports, it may be impossible to break any of the world's low-cost copper records until after land transportation rates are reduced. In another year or so this obstruction to low copper costs will be swept away by the completion of the Benguella Railway, the new line to the west coast. This railway, built primarily to serve Union Minière du Haut-Katanga, has its terminus at Lobito Bay, a great natural harbor which is 3,000 miles nearer European ports than Beira and 1,450 miles nearer than Cape Town. Being a watershed route, the Benguella Railway should not be crippled in the rainy seasons, as the other line invariably is, and having a steady down grade to the coast it should be economical to operate. It will cut over 200 miles from the distance Union Minière's copper and imported supplies must be transported by land, and when one or two inevitable lines have been built through northwestern Northern Rhodesia to a connection with the Benguella Railway, most of the new mining properties will be nearer Lobito Bay than Beira. Bwana M'Kubwa, N'Kana, and N'Changa will be about the same distance from the two ports when the Benguella Railway proper is completed. This railway, it has been estimated, will save £7 per ton (over 1½c. per pound) on the cost of delivering Katanga copper in Europe. Whether the saving of over a week's interest annually on nearly $30,000,000, to be effected by the reduction of time required to get Union Minière's production to market, was included in this estimate is not known, but it is a highly important item. By having the effect of creating competition for traffic, the completion of the Benguella Railway undoubtedly will be followed—not unlikely will be preceded—by a general reduction of freight rates on the South African roads. Passenger tariffs will be cut also.

### Operating Cost Low

As to the cost of handling ore, there is no reason why the same kinds of machinery, equipment, processes, and managerial methods that are employed by American mining companies cannot be installed and operated succesfully in Africa. This, it is understood, is the plan. Common labor being cheaper for mucking, tramming, and surface work, the opinion has been expressed that the cost per ton of mining and treatment may be even lower than it is where underground practice is employed in America. The total cost per ton of ore, including the expense of transporting and marketing the copper, probably always will be higher because there is so much more copper per ton to transport and sell. But the advantages arising from the fact that Africa's copper ores are so much richer call for further consideration. To produce each 100,000 long tons of copper, American mining companies are treating, as an average, over 7,000,000 tons of ore. The African companies will recover the same amount from the treatment of less than 3,000,000 tons. It may be that some of the African managements will for a time expend twice the amount per ton that the Americans do, but it is inconceivable that they will be content to continue doing so. As they have ores of more than double the gross value per ton of those being treated in America, "twice as much to play with," the new African companies feel that they are sitting into the game with a tremendous advantage.

Although the equipment of a mining property entails a greater expenditure of capital than before the war, this is fully offset by the advantage of being able to start with a full knowledge of the great improvements which have been made in copper producing practice during the last few years—improvements which are enabling most of the American companies to increase their dividend rates notwithstanding the continuing low price of the metal. The disadvantage of higher equipment cost is offset again by the fact that the new African plants will need to be less than half as big to turn out a given annual production of copper as the average American plant, because Africa's ores are so much richer. For the same reason the fuel consumption and the wear and tear per ton of copper produced should be smaller in Africa. Still another advantage may be mentioned. It is that good mill sites are available, with abundant water supplies, convenient to each of the Rhodesian ore occurrences. The hauling of ores to water, as in the Western United States, and the bringing of water scores of miles to the mines, as in the cases of the South American copper producers, will be wholly unnecessary.

One small copper producer in Africa is furnishing definite proof that low operating costs are possible. The Messina (Transvaal) Development Co., Ltd., is mining a relatively narrow vein of sulphide ore that contains neither gold, silver, nor other commercial byproducts. Its two mines, already comparatively deep, are worked chiefly with native labor, and the ore is milled and the concentrates are smelted in the company's own plants. During the year ended June 30, 1926, Messina (Transvaal) Development mined and concentrated 198,643 tons of ore averaging 3.02 per cent copper. It had only 14,465 tons of concentrates and hand-picked ore to smelt, or about 40 tons daily. Yet, on the 5,398 tons of copper (99.09 per cent fine, not quite up to "best selected" grade) produced for shipment during the year, it realized an operating profit of £93,610 ($454,947). As this was a profit of 3.77c. per pound on the production of 12,091,526 lb. of copper which was sold unrefined, a cost of 10c. or less is indicated, this including taxes, London and traveling expenses, which exceeded $44,000, and the other items usually charged to cost. It may well be doubted that a similar property so operated in the United States would have paid expenses, especially if, like this one, it were off the main line of railway at the far end of a branch 148 miles long.

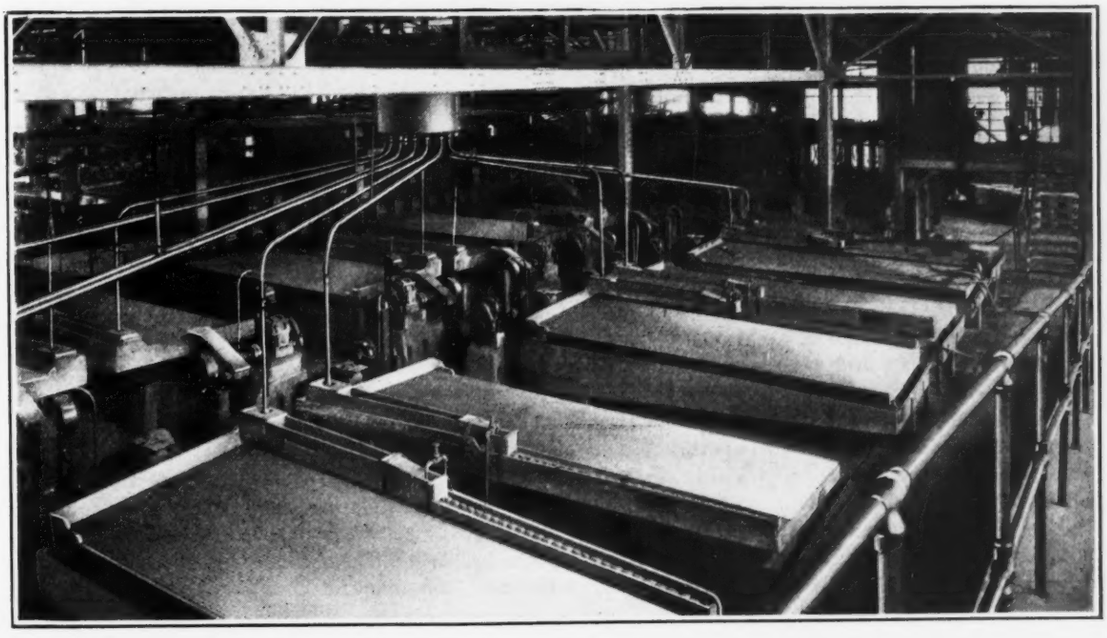
As there were no conditions specially favorable to low costs at the Messina (Transvaal) Development property, none that will not correspondingly assist companies operating farther north in the Rhodesias, it is apparent that those who are trying to argue that no cheap copper ever will come from Africa are wasting their energies. Instead of combating facts, those interested should find a way to take advantage of them.

The belief that Union Minière's record is a criterion of future copper producing costs in Africa should be abandoned. That company will soon be mining 3 to 9 per cent carbonate ores with steam shovels and leaching them with sulphuric acid, and the copper from the solutions, precipitated by hydro-electric current, quite possibly may be produced at the lowest cost of any in the word. At first, Union Minière will import sulphur, but it now is developing sulphide ores which later on should provide a local supply of sulphur.

The African copper region is not nearly so far "off the map" as seems to be commonly believed. Lobito Bay is less than half again as far from England as is New York. Even Beira is nearer Europe than the South American port from which Chile Copper's production is largely being imported. There are warehouses at Johannesburg and shops in which even the heaviest mining equipment can be rebuilt, so that machinery service can be secured without undue delay. In consequence construction progress should be much faster than it was when the South American mines were being equipped.

This article outlines information, believed to be reliable, which has been obtained by two years' close study of African copper production, progress, and developments. The discovery that the Rhodesian deposits change at comparatively little depth to sulphides, making the ores amenable to flotation and assuring a high grade of concentrates, is important. It has been mentioned that these ores may become a source of sulphuric acid for leaching, and attention might be called to the fact that the Southern Rhodesia Base Metals Corporation, Ltd., is developing copper-lead-zinc ore in what appear to be enormous deposits, the pyrrhotite gangue of which could be recovered if desired by magnetic separation; but this is not intended to distract attention from the ammonium carbonate leaching process of the Metals Production Co., which is being employed by Bwana M'Kubwa. The object is to point out that sulphur will be obtainable if wanted.

The probability is that ammonium carbonate leaching will soon establish its superiority as a process for the treatment of Africa's carbonate ores; it is simple, calls for no high temperatures except for the actual smelting of the copper precipitate, no fine grinding, and it recovers such small quantities of the metal as may exist in the form of oxides, silicates and sulphides. The point is that sulphur now being readily obtainable, as well as iron and limestone, the African companies are in a position to choose any of the known processes of copper recovery that may seem most desirable. Central Africa's copper-producing potentialities are not to be ignored.



**Concentrating tables in mill of Consolidated Mining & Smelting Co. of Canada, at its Sullivan mine, Kimberley, B. C.**

# Solving a Problem in Smelting Rich Lead Concentrate

*Roasting in a Revolving Drum Followed by Single Sintering Suggested—Dust Loss Would Then Be Less*

By G. N. Kirsebom
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THE INTRODUCTION of selective flotation of lead-zinc ores has upset the long-established practice of lead smelters; zinc is no longer present in undesirable amounts, requiring special consideration from the smelter, but, on the other hand, one must deal with an oily, sticky concentrate running 60 to 70 per cent of lead. The old practice in most smelters was to pre-roast the gravity concentrate, which usually carried considerable pyrite, and then to mix this pre-roast with raw ores and sinter in such proportions that the desired kind of sinter shall be produced. The pre-roasting process was carried out usually in multiple-hearth roasting furnaces under highly oxidizing conditions, necessitating large volumes of air and usually resulting in heavy dusting. With the high-grade lead concentrate, such practice did not seem desirable, in view of the dust loss and also because of the fact that the concentrate contained so little pyrite that a cheap iron flux could no longer be secured in this way. Gradually, a double sintering process has been developed in most of the Western lead smelters. The high-grade barren pyrite obtained as a byproduct in milling seems to be the cheapest form of iron flux available in most places; this material may well be roasted in the multiple-hearth furnaces, many of which are available for the purpose through the change in practice above outlined.

In carrying out double sintering, all the lead concentrates go into the sintering charge, with suitable fluxes. The first sinter obtained usually has a loose structure and is high in sulphur; it is crushed and re-sintered to bring the sulphur content down to the proper point and to secure the desired physical structure. In smelters where double sintering has been practiced for some time, good mechanical arrangements have been made, so that the cost of the entire process has been brought down to a minimum, and it would seem that the smelters have satisfactorily solved the problem of handling the rich flotation concentrate.

From a chemical point of view, however, the practice is far from perfect, for the reason that when galena is sintered it tends to melt before it roasts, and in such molten condition does not oxidize so readily. The 3 to 4 per cent of sulphur present in the second sinter is still largely in the form of lead sulphide, which tends to increase the amount of lead going into the matte. The dust loss, as already remarked, is also greater with the fine rich concentrate. The re-treatment of this dust is expensive and a nuisance, so it is a question whether the smelters have found the most economical solution to the new problem.

At one Western smelter, which recently constructed a selective flotation plant, sale of the zinc concentrate has netted a good profit, but outside of the elimination of this undesirable constituent from the lead charge, the smelter operators feel that they are rather at a disadvantage. Formerly, at this plant, many low-grade ores were received, so that the charge for sintering rarely assayed more than 16 per cent lead. Under the new conditions, the high-grade concentrates had to be diluted with other ores not suitable for flotation, with the result that a charge running about 20 per cent lead was obtained. To double sinter such a charge meant an added expense, and as the byproduct pyrite had to be disposed of, containing as it did about 2 per cent of lead and considerable gold, it was decided to use the roasting furnace for pre-roasting this material, and add the concentrates direct to the sinter charge. In this instance, double sintering seemed to be unavoidable. As the tonnage of pyrite to be put through the roasters was considerable, the double sintering would at least mean an extra expense compared to the old procedure, and it would also mean a large expense for new construction. The trial tests also showed a large increase of dust from the sintering operation, and accumulation in the roaster flues of a material low in metal content but high in sulphur, that would have to be disposed of in some way.

Lead sulphide in the form of finely divided flotation concentrate can be roasted in a revolving drum completely to lead sulphate and lead oxide at a temperature of from 450 to 600 deg. C. The resultant material appears like a heavy sand, and does not stick to the sides of the drum during roasting provided it does not contain chlorides. In addition to being in good physical condition, this material will combine readily with the necessary fluxes to give a good sinter, using flotation pyrite for igniting. Tests carried out in a diminutive sintering machine have shown that the mixture of lead sulphate and lead oxide obtained in this way may be sintered, using comparatively large amounts of flotation pyrite in the charge, along with the necessary amount of low-grade siliceous ore, giving a good sinter running below the limit in sulphur, in one treatment. The dust loss could not be determined with accuracy, although it was proved that a saving was made in the valuable metals lost in fume.

In most smelters where double sintering has been introduced the roasters formerly used stand more or less idle. These might be changed structurally at little expense, so as to roast the high-grade concentrate to lead sulphate and lead oxide. Any flotation pyrite available may then be introduced with this roasted product into the sinter charge, and sent through the machines once. The fact that a large amount of oxidized lead is present will greatly lessen the danger of the formation of elemental sulphur, which was discussed in an article in the Jan. 1 issue of this magazine. From a chemical standpoint such a procedure would be logical, though large-tonnage tests would be necessary to prove its economic worth. Its tendency to cut down dust losses is distinctly in its favor, as no satisfactory method of treating such dust has yet been devised.

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### Eleven Rand Mines Recover Less Than $5 a Ton

Altogether there are fourteen low-grade mines on the Witwatersrand, says *The Mining and Industrial Magazine*, and an analysis of the November returns reveals the fact that eleven of these mines recovered less than 5 dwt. ($5) of gold per ton of ore milled. They distributed £423,880 in working costs for an estimated profit of only £32,605. There is a shortage of 12,000 mine laborers along the reef, and the poorer mines are always the first to feel the brunt.

# Alternating Current Prospecting Methods of Limited Application

## *Only Below a Certain Value for the Specific Resistance of Rocks Can Different Minerals Be Distinguished From One Another*

By Dr. Richard Ambronn
Göttingen, Germany

*Dr. Richard Ambronn*

GEOPHYSICAL prospecting methods are based on the utilization of differences in the physical qualities between the deposits sought in the interior of the earth and the ordinary strata surrounding them. In actual practice only such physical qualities are utilizable as have a sufficient effect in distance through the overlying strata, and even these are useful only when the difference between the object sought and all other parts of the surrounding strata are sufficiently great with reference to the respective geophysical qualities to afford, under the conditions peculiar to the respective geophysical peculiarities as regards size, shape, and depth of the substance sought, a sufficiently strong and characteristic effect at the accessible places of observation. Whereas, for instance, in gravity-measuring operations and in seismic investigations by means of artificially excited elastic waves, differences of a few per cent in thickness or density or the velocity of sound in the substance sought as against its surroundings under favorable conditions are sufficient and, as a matter of fact, only relatively small differences between the different strata occur at all, these conditions with electrical subsoil examinations present a substantially less favorable aspect in themselves. To this must be added that the electrical processes are used preferably for finding small, thin objects, such as veins, lenses, and other deposits of conducting ores, water-conducting throws or slips, porous sand strata filled with salt water in the vicinity of oil deposits, and the like. So the ratio of the substance sought as against the worthless rock is a particularly more disadvantageous one here. Moreover, in electrical examinations, for the special execution of which in practice the reader is referred to certain literature (for instance, R. Ambronn, "Methods of Applied Geophysics," Dresden, 1926, where the rest of the literature is also tabulated), it is not practicable to use the direct demonstration of the quality peculiar to the substances sought—that is, the electric conductivity—through their own long-distance effect, but rather the indirect effect on a current supplied to the soil due to the spatial distribution of the electrical conductivity in the latter.

The plurality of the factors affecting the sensitiveness and the range of electrical prospecting does not permit an accurate appraisal or even calculation of the minimum difference in the electrical conductivity required for a reliable differentiation of the substance sought as against its environment. One must effect this appraisal, which, of course, is of fundamental importance in examining a task as to its suitability for electrical treatment, by means of actual experiences. As a measure it will be advisable to use, not the difference in conductivity, but the *proportional* number, as the current distribution in the subsoil depends on the latter alone.

By means of a survey of the tasks described in literature and which have become known to me during many years' practical use of electrical methods, it is seen that the conductivity ratio between the substance sought and its environments in vein- or deposit-like occurrences must be at least 1,000: 1, but for the most part very much greater in order to promise unobjectionable measurements. A few examples may serve to elucidate my opinion:

1. A conducting vein of galena in slaty rocks. Galena with pyrite, some blende and vein minerals mixed, has a resistance of about 1 ohm per cubic centimeter. The slates, generally weakly moist, show a resistance of $10^5 = 10^9$ ohm cm.$^{-1}$. The ratio of conductivity, therefore, is 0.1 — 1,000 million in this case.

2. A hematite deposit in dry lime. Hematite has a resistance of about $10^6$ — $10^7$ ohm per cubic centimeter, but in dry lime resistances are measured of $10^{10}$ and more ohms cm.$^{-1}$. The ratio of conductivity therefore is $> 10^3$. From a practical viewpoint the demonstration of hematite by electricity lies at the limit of what is possible and can be presumably effected with sufficient certainty only if it contains abundant pyrite and magnetite, whereby its specific resistance is considerably reduced.

3. Porous layers or strata filled with salt lyes in weakly moist clays. Salt lye of a concentration of 5 per cent has a resistance of 15 ohms cm.$^{-1}$. Porous sands saturated with this solution therefore possess a mean resistance of about 100 ohms cm.$^{-1}$ against a resistance of at least $10^5$ ohms cm.$^{-1}$ of the clays. The conductivity ratio is greater than 1,000.

These examples show that in actual practice a conductivity ratio of about 1,000 and more may be regarded as admissible for an electrical examination of the sub-

soil. This reflection, however, finds a restriction if the examinations are made with alternating current and the differentiation between substances already poor conductors in themselves is involved. In such a case there must be added to the current which is caused by the conductivity (determined by the specific resistance) of the materials, also the so-called displacement current which is created by the electrical capacity of the more conductive soil layers toward one another.

The direct-current resistance $w_e$ of a small column, of height $d$ and cross-section $q$, of a rock having electrical conductivity $\lambda$, according to Ohm's law, is

$$w_e = \frac{d}{\lambda q} \text{ ohm} \qquad (1)$$

in which connection the conductivity $\lambda$, as is well known, equals the reciprocal value of the resistance of a centimeter cube ($d = 1$ cm., $q = 1$ cm.$^2$) of the respective material.

The corresponding resistance $w_c$ as against the displacement currents on the other hand, is

$$w_c = \frac{1}{\omega C} = \frac{4\pi d}{\omega q \delta} \times 9 \times 10^{11} \text{ ohm} \qquad (2)$$

in which $\omega$ is the alternating number, of the measuring current in $2\pi$, or $2 \times 3.142$, seconds (the circuit frequency), $C$ the capacity of the two ground areas of the small column as against each other in electromagnetic measure, and $\delta$ the dielectricity constant of the rock material, while the number factor $9 \times 10^{11}$ effects the conversion into ohm values.

The total resistance of such a small column toward the alternating current with which one charges the soil being $W$, then one can calculate with sufficient accuracy according to the formula for the composition of two resistances connected parallel to each other, as follows:

$$W = \frac{w_e w_c}{w_e + w_c} = \frac{d\,(9 \times 10^{11} \text{ ohm})}{q\,(\omega\delta + 4\pi\lambda \times 9 \times 10^{11})} \qquad (3)$$

while the ratio of the two resistances to each other figures out:

$$w_e : w_c = \omega\delta / 4\pi\lambda \times 9 \times 10^{11} \qquad (4)$$

From these formulas some very important practical conclusions will now be drawn.

According to expression (4) the ratio of the two resistances for a given rock material is entirely independent of the geometrical dimensions.

From (3) it follows, however, that for $\lambda = 0$, that is to say for a completely insulating rock, the resistance against alternating current does not become infinitely great either, as it does for direct currents, but possesses a final limiting value which figures out

$$w_c = 36\pi \cdot 10^{11} / \omega\delta \text{ ohm cm.}^{-1} \qquad (5)$$

The dielectricity constants of the most important rocks as limestone, sandstone, and slate are found approximately to 10. The circuit frequency $\omega$ for normal alternating current (50 per second) is about 300; in the electrical-prospecting operations mostly 3,000; only a very few investigators consider frequencies of up to 30,000 as useful. In order to give a survey of the limiting value of $w$, the values of $w_c$ for $\omega = 300$, 3,000 and 30,000, and for $\delta = 1, 2, 5, 10$ are therefore to be compiled in a table.

Of the greatest importance from a practical standpoint for modern electrical research is Column 3 for

*Table for the limit resistance $w_c$ (in ohms cm.$^{-1}$.)*

| | $\omega$ | | |
|---|---|---|---|
| $\delta$ | 300 | 3,000 | 30,000 |
| 1 | $40 \times 10^8$ | $40 \times 10^8$ | $40 \times 10^7$ |
| 2 | $20 \times 10^9$ | $20 \times 10^8$ | $20 \times 10^7$ |
| 5 | $8 \times 10^9$ | $8 \times 10^8$ | $8 \times 10^7$ |
| 10 | $4 \times 10^9$ | $4 \times 10^8$ | $4 \times 10^7$ |

$\omega = 3{,}000$, which therefore has been inclosed in heavy rules. This shows that the alternating-current resistance in the soil, when using the customary 500-cycle alternating current, can never exceed the value of approximately 1,000 million ($10^9$) ohms per cubic centimeter.

Now, inasmuch as it was already previously shown that for an electrical-prospecting operation at considerable depths conductivity ratios of at least 1,000 between the substance sought and its environment are required, and inasmuch as the most important rocks have a dielectrical constant of 10, one thus reaches a limiting value of 400,000 ohms per cubic centimeter, above which different kinds of rock are entirely non-separable under normal conditions by means of electrical measurements.

It is therefore necessary to adopt, with reference to the conductivity of rocks in electrical prospecting operations, a sharp limit in the specific resistance of rocks, as indeed has been done by Krahmann, for instance, (only as a matter of feeling), at 250,000 ohms cm.$^{-1}$. But this limiting value must be given a much deeper significance than was done by Krahmann, as it is only below this limiting value that there is any possibility at all of differentiating various minerals or mineral mixtures from one another by means of electrical alternating-current measurements at the depths entering into practical consideration. All strata of the earth's crust with a higher specific resistance belong to a uniform mass which cannot be analyzed any further electrically. Therefore, for instance, all attempts to differentiate layers of dry rock, salt, or formations containing petroleum, by means of electrical alternating-current measurements, are absolutely unpromising from the first, and electrical measurements in oil fields can never show anything but the distribution of relatively conductive strata containing water, in particular salt lyes, as against the dry or partly oil-conducting beds. Strange to say, in the publication of such electrical measurements which were obtained in oil fields, no attention has evidently been given to the preponderating influence of the high-conductive salt lyes undoubtedly existing there, whereby their value even as regards a critical examination unfortunately has been wholly lost.

## Lead Aluminate—A New White Pigment

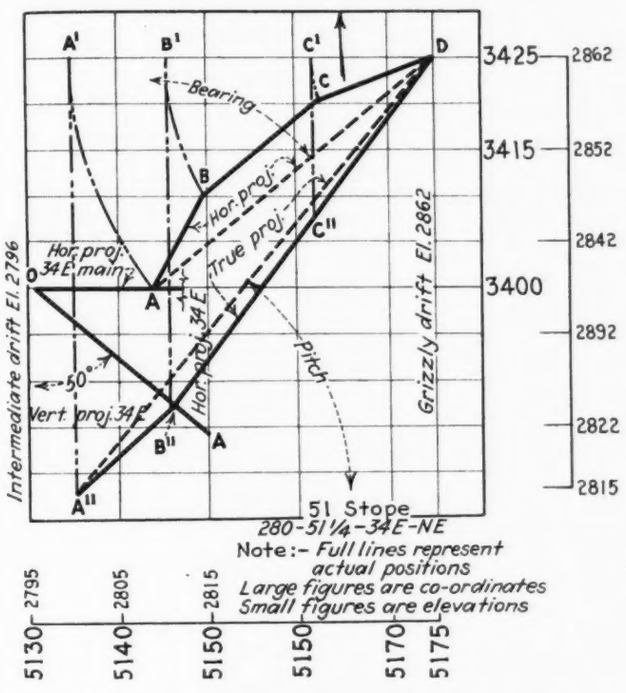
Lead aluminate is a pigment prepared from litharge and alumina which is stated (*Chem.-Z.*, 50, 662) to be pure white in color, resistant to dilute acids, unaffected by hydrogen sulphide, and with a covering power equal to that of white lead. *British Chemical Abstracts* says that interesting results have been obtained with other materials, such as titanic anhydride, using a method in which the litharge and alumina in very fine division and intimately mixed are heated with stirring for a long period at 700 deg. C., a temperature at which the materials are not fused, reaction taking place between the solid constituents.

# Useful Operating Ideas

## Graphic Solution of Branched Raises

By A. D. Rood

Determining the bearing and pitch of a raise between two points whose co-ordinates and elevations are known involves at least three separate trigonometric calculations when the points do not lie in a plane that is parallel to either one of the co-ordinate lines. In addition to these calculations, six more must be made in case the raise goes off line and off grade. A graphic




*Graphic diagram used in determining bearing and pitch of raise*

solution of the same problem on co-ordinate paper requires the plotting of the co-ordinates of the two ends *A* and *O* of the raise in a horizontal plane and a true projection of the line between those two points to find the vertical angle between the line and the horizontal. This method has proved efficient and accurate for distances up to 125 ft. and at the same time provides a permanent record of actual positions, as plotted from Brunton compass observations.

The co-ordinate paper used is centimeter graph paper, subdivided by lighter lines 2 mm. apart. Each sheet is 8x10½ in., with a wide margin on one side so that it may be filed in a loose-leaf notebook. The scale used is 1 cm. equal to 5 ft. The results obtained by using this scale with an ordinary drawing compass, and a protractor graduated in degrees, check within one degree of those obtained by trigonometric calculations for a distance of 125 ft. These results correspond to the accuracy of a Brunton compass.

Following is the procedure of plotting raise number 280—51¼—34 E—NE. The vertical projection of No. 34 E. main (O—A) is plotted to determine the position of point *A*, from which the raise starts, in a horizontal plane. Point *D* is then plotted in a horizontal plane. The angle between the line connecting these two points and a north line passing through Point *A* is the bearing between the two points. The true projection of *A*—*D* is found by revolving Point *A* to a vertical plane which is parallel to one of the co-ordinate lines and which passes through point *D*. Point *A'* is then plotted in this vertical plane (A") and the line *A"*—*D* is the true projection of *A*—*D*. The angle between the line *A"*—*D* and the horizontal is the pitch of the raise. As the raise advanced, two observations were taken with a Brunton compass and plotted in the office. One observation consists of a bearing between two points, the distance between them and the vertical angle between the line connecting them and the horizontal. First the vertical angle is plotted (pitch) and the measured distance of the course laid off on this line (*A"*—*B"*). Then *B'* is the horizontal projection of *B"* in the vertical plane. The line *A*—*B* is the observed bearing. The intersection of the arc *B'*—*B* and the line *A*—*B* locates Point *B* in the horizontal plane. Point *C* is located in the horizontal plane in the same manner from observations taken on the course *B*—*C* and the final bearing and pitch from Point *C* to Point *D* taken from the graph.

## Roller Bearings on Copper Converters

On the original installation of the worm-gear drives on Nos. 7, 8, and 9 converters at the Garfield plant of the American Smelting & Refining Co. a series of thrust washers was installed to control the thrust of the worm, and because of the heavy thrust load on them, these thrust washers gave considerable trouble, the life being indefinite. Some would last only a few hours, whereas others would last thirty days at the most, and in case they did stand for thirty days a great deal of wear resulted, varying from ⅛ to ⅜ in. in that period. The effect of this excessive wear was to place a very severe strain on the drive as a whole, owing to the back lash of the worm. The time required to change the thrust washers is from four to eight hours, depending on which end of the worm the wear had taken place. Frequently this caused considerable delay on the converters.

To overcome the trouble a Timken thrust bearing was installed on the No. 8 converter on Aug. 9, 1925, and after three and a half months of service it was opened up for inspection and found to be in perfect condition. Owing to the fact that the gears stripped on this converter the worm shaft was badly sprung, which necessitated its removal. It was placed in service again on April 4, 1926, and has been in steady service from that date to the present without a single adjustment for wear, and it is still in good condition and will give several months' service.

A similar improvement was applied to the new No. 6

converter and placed in service Feb. 23, 1926. Since that date it has given the same results as on the No. 8 converter. As a matter of comparison, in the same period that the Timkens have been in service the thrust washers have been changed on the No. 7 converter five times, and four times on the No. 9 converter.

### A Time Saver

Another feature of this improvement is its accessibility, the bearing as a whole being mounted on the outside of the worm case, and when necessary to change the bearing while operating it could be accomplished in about one hour as compared to four to eight hours on the old type of thrust bearing.

At present material has been assembled for changing No. 9 converter over to Timken thrusts and also to convert the worm drive on the No. 2 copper wheel in the copper-casting division to Timkens. Copper elevators should also be equipped with this thrust, as considerable trouble is experienced with the present installations.

## To Remove a "Frozen" Shaft

Removing a "frozen" shaft or a crank pin from a gear or pulley involves trouble. *Oxy-Acetylene Tips* suggests a cutting blowpipe and an oxygen lance for the job. The oxygen lance consists of a length of $\frac{1}{8}$-

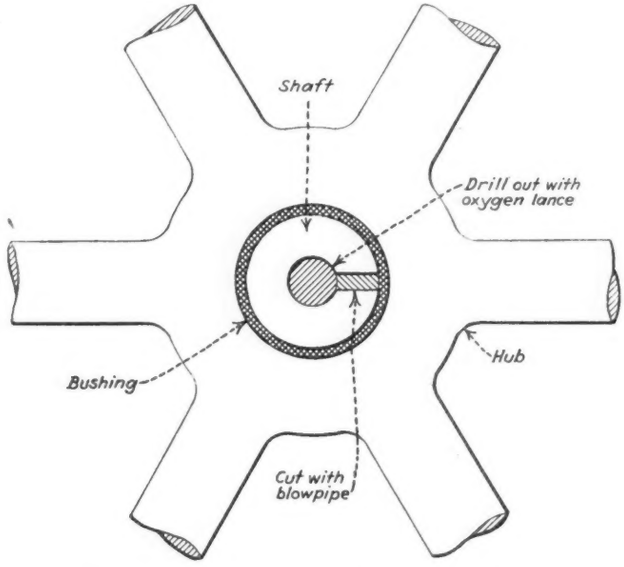



*Fig. 1—Sectional view through pulley hub*

or $\frac{1}{4}$-in. iron pipe attached to a piece of oxygen hose. To cut out a frozen shaft, the first step is to cut the shaft off with the cutting blowpipe near the pulley hub on both sides. The pulley is then placed in a horizontal position, and with a welding blowpipe a spot in the center of the shaft end is heated to a bright red. The oxygen lance is directed against this hot spot with oxygen at about 10-lb. pressure, passing through the $\frac{1}{8}$-in. pipe. A hole will be drilled rapidly through the shaft, the pipe being consumed at the same time. More than one length of pipe may be required for a deep hole, and the oxygen pressure should be increased gradually, to blow the molten metal and the slag up and out of the hole. When the hole is completed and the metal is still warm, slot the shaft to one edge with the cutting blowpipe as shown in the accompanying sketch. The slot can be easily made to the edge of the shaft through the length of the shaft section by starting it on the hot edge of the lance-drilled hole. The shaft can usually be then knocked out.

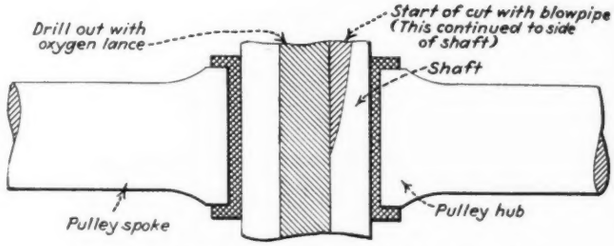
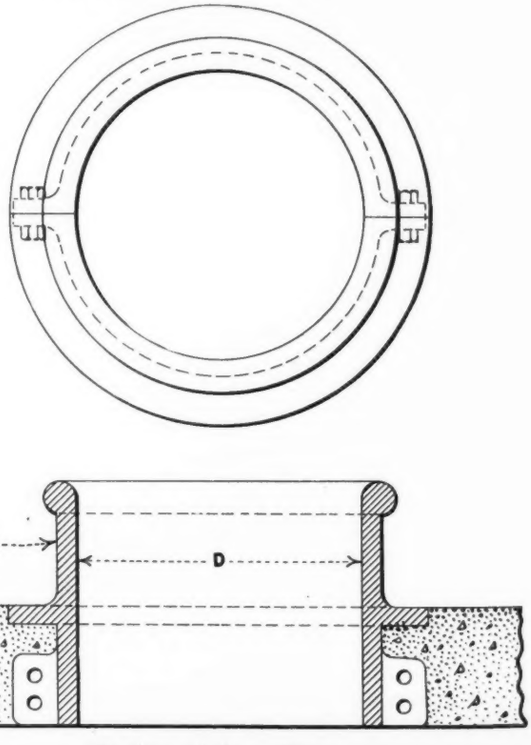



*Fig. 2—Plan, showing method of cutting*

## Handy Floor Sleeve

**By W. F. Schaphorst**

An engineering concern in the East uses a floor sleeve, designed as shown in the accompanying sketch, for pipes passing through all kinds of floors. The curb *C* is intended to protect the pipes as well as to give a neat appearance about the pipe opening. It also serves to prevent sweepings from the floor above passing through the hole. The floor sleeve is made of cast iron and in all sizes. It is also made with split lugs for the larger sizes or for placing around pipes which are already in position. To assure concentric alignment of the sleeves with pipes it is advisable to leave holes in the floors larger than actual requirements and to put the pipes in place and then locate the sleeves and grout them into position with cement. The inside diameter of the pipe sleeves should be large enough to allow passing the flange or coupling of the pipe through. For larger sizes *D* may be made two inches larger in diameter than the diameter of the pipe flange. This allows for easy working and avoids trouble if at any time changes in piping are necessary.




*Design of floor flange*

# Discussion

## Propaganda

THE EDITOR:

Sir—In the issue of *Engineering and Mining Journal* of Feb. 5, 1927, on the first page, there is an article re the oil lands in Mexico. This article is not true. It is misleading propaganda on its face. It quotes from the *New York Evening Post* of Jan. 25, 1927, an article by George Barr Baker, formerly associated with Herbert Hoover during the World War. (Why bring his name into it? He is in no way responsible for any of the acts of the hundreds who were under his orders ten years ago.)

Baker states that of the 666 foreign companies owning lands obtained prior to May, 1917, all but twenty-two have complied with the law which required them to turn in to the Mexican Government their titles in fee simple, and take concessions. Six per cent of the total refused to comply.

The editorial also quotes the *New York World* as saying that "The heart of the opposition appears to be a group of men who were interested in defrauding the United States Government in the Teapot Dome and Elk Hill leases." The editorial appears to convey the idea that the object of the Mexican Government is only to perfect the titles to these oil lands. It overlooks and does not state that the Mexican Government insists upon taking up and canceling the present titles in fee simple in perpetuity, and giving in their place a concession for fifty years, less the time since the title was obtained, with possible extension at the pleasure of the Mexican Government. It is generally understood that a "concession" may be canceled at any time by act of the Mexican Congress, by decree of the President, or by rules and regulations of the Secretary of that Department in charge of those interests, upon failure to comply with any of his numerous regulations. This is the object of changing titles in perpetuity for a concession.

The Secretary of State, at Washington, D. C., on Feb. 16, 1927, sent to the U. S. Senate, upon request of its resolution for information upon this subject, the following data: "That 90 per cent of the owners of oil lands in Mexico acquired by foreigners prior to May 1, 1917, have not complied with the law, given up their titles in fee simple for concessions."

The names of all of these companies and individuals are given (forty-seven); also the four companies that did comply with the law; but two are not producing oil and the other two have no lands in fee simple. He also states that this 90 per cent who did not comply with the law represent 70 per cent of Mexico's oil output.

The Secretary of State also says that, according to Article 27 of the Mexican Constitution, it appears probable that concessions cannot be granted under it. Also that the Attorney General of Mexico, in the *Diario Official* of Dec. 8, 1917, stated that under the new Constitution alien companies shall in no event acquire lands.

It is the truth—facts—that are wanted, not the falsehoods and propaganda that have been fed to the American public for the last ten years, paid for, probably, by Soviet Russia's gold.

It is understood that the investments of foreigners in agricultural lands in Mexico far exceed in value the interests in oil lands. Many thousands of acres have been confiscated, without one cent of recompense.

The writer has no interests whatsoever at this time in any oil or agricultural lands in Mexico; he regrets that owing to professional interests that call him to Mexico it is not advisable to sign his name.

El Paso, Tex. DON LEMMON.

*Editor's Note:* In connection with the foregoing letter, there is quoted herewith Article 46 of the Law of Mineral Industries, May 3, 1926, which states: "The granting of new concessions for mining exploitation will not be required in connection with land that is covered by a title issued in conformity with the Law of Nov. 25, 1909, or those which preceded it, as long as this title does not become lapsed, in accordance, respectively, with the same laws, but the execution of the works of exploitation shall be subject to the relative regulation of the present law."

Under date of Feb. 24, 1927, President Calles in a letter to Senator William E. Borah states that there are 380 companies which hold "643 petroleum concessions on lands with claims previous to May 1, 1917. . . . These concessions embrace a total of 26,835,000 acres. The lands with claims prior to May 1, 1927, which the 22 companies possess who did not comply with the petroleum law, embrace a total extent of 1,661,999 acres. Consequently, the lands which have not complied with the petroleum law represent approximately 6 per cent of the total area of land on which claims exist prior to May 1, 1927." It is true, however, that the recalcitrant companies represent by far the larger production.

## Proofs of Secondary Enrichment

THE EDITOR:

Sir—In your issue of Feb. 12 Mr. F. R. Koeberlin writes with reference to secondary enrichment of Bolivian tin-veins: "One investigator actually proved, by a series of experiments, a slow solubility of cassiterite with solvents that are likely to occur in the oxidizing zone of the tin veins. A bit of positive proof outweighs a mass of negative evidence."

The last remark is correct; but we must make sure of our bit of positive proof. Slow solubility of cassiterite does not necessarily involve secondary enrichment; a very dilute solution of a comparatively insoluble mineral might easily be dissipated, especially near surface, where the tin-bearing veins are probably not the only channels through which solutions can penetrate.

The question is of special interest to me in studying the parallel questions involving possible secondary enrichment of ferberite veins in Boulder County, Colo. There is here, I think, indisputable evidence that ferberite has been removed in solution, from the portions of the veins near the surface; but I know of no definite evidence that it has become redeposited lower down.

Denver, Colo. GEORGE E. COLLINS.

# Consultation

## Concentration by Flotation

"Can you tell me what proportion of the metalliferous ores concentrated are treated by the flotation process?"

The most reliable estimate on this point is probably that made by Thomas Varley, metallurgist for the U. S. Bureau of Mines at Salt Lake City. Although he did not obtain reports from all the operators, he believes that his data cover about 96 per cent of the tonnage treated. He estimates that in 1924 about 95 per cent of the copper ores, 28 per cent of the lead ores, and 6 per cent of the zinc and zinc-lead ores were concentrated in part at least by flotation. The progress in introducing flotation for the treatment of ores containing zinc has been exceedingly rapid in the last few years, and the figure 6 per cent doubtless has been increased largely. The so-called complex zinc-lead ores in general can be satisfactorily concentrated only by the use of flotation. Moreover, in Joplin, where the minerals are not so intimately mixed, the use of flotation has been increased materially. Mr. Varley has made the following estimates of the tonnages of ore "floated" and the concentrate produced:

| Year | Ore Treated, Tons | Concentrate Produced, Tons | Ratio of Concentration |
|---|---|---|---|
| 1923 | 37,811,000 | 2,132,600 | 17.73 |
| 1924 | 45,105,000 | 2,298,300 | 19.63 |
| 1925 | 45,490,000 | 2,790,500 | 16.30 |

## Metallurgy of Tin

"I am interested in the method of recovering tin from its ores. Can you give me a general idea of the process?"

The U. S. Bureau of Mines has issued a circular that outlines the principles of tin metallurgy in a concise way. The following is quoted from this pamphlet:

"Most of the supply of metallic tin is recovered from cassiterite by smelting. This method of obtaining tin was evolved in prehistoric times when primitive man heated a mixture of the ore and a reducing agent, such as charcoal, to a high temperature. In modern practice ore, or concentrates containing 1 or more per cent of sulphur are roasted before they are smelted. This roasting is necessary because the tin sulphide, or matte, formed in the smelting of a tin ore containing noteworthy amounts of sulphur is readily volatilized. The volatilization not only causes much loss of tin but gives by-products that are difficult to reduce. In the roasting process the temperature maintained is sufficient to drive off the sulphur and to leave less than 0.005 per cent in the ore.

"In smelting the roasted ore or concentrate, which contains upward of 60 per cent tin, it is as a rule thoroughly mixed with 20 to 30 per cent of pulverized anthracite. The remainder of the furnace charge consists of silica, iron, and lime in sufficient quantities and proportion to give a slag containing approximately 35 per cent silica, 12 per cent iron, and 25 per cent calcium oxide. Ores low in iron can be smelted in one operation, but those containing more than 3 per cent of iron require two-stage smelting, in which 85 to 90 per cent of the tin is reduced during the first stage. The slag, which is resmelted, contains the rest of the tin, and yields an alloy of tin and iron. The separation of the tin in this alloy accounts for the major part of the cost of getting the metal from the ore. To separate the tin small amounts of the alloy are mixed with crude ores relatively free from iron, and are smelted.

"A minor difficulty in the smelting of tin is that tin oxide combines readily with silica to form tin silicate, and often if too much silica is used in the flux or is contained in the concentrate the first run of slag must be resmelted. In general, tin smelting embraces three distinct stages: primary smelting in a blast furnace or reverberatory, resmelting the slags obtained, and freeing the tin from the impurities that were reduced with it during these processes. Two methods of refining are used—heat-treatment and electrolysis. Heat-treatment as a rule involves liquating, boiling, and tossing or poling. Electrolytic refining is based upon the position of tin in the electromotive series of the metals, where lead is the only metal that stands equal or close to it. The tin electrolyte must contain a radical that will form an insoluble compound with lead, such as sulphate, chromate, or fluoride. Arsenic, antimony, bismuth, copper, and the other metals that may be present as impurities in tin are not dissolved in this process and remain in the anode slime. A hydrofluosilicate acid bath is used which consists essentially of $H_2SiF_6$ with enough $H_2SO_4$ to prevent lead from depositing by precipitating as lead sulphate. This process has been covered by a series of patents."

## Copper Produced From Open-Cut Workings

"What proportion of the world's total output of copper is derived from steam-shovel mining operations?"

In all probability the inquirer uses the term steam shovel to include all kinds of power shovels. The present-day tendency is to use electricity to operate shovels wherever electric power is available at reasonable cost. With this qualification in mind, the accompanying table will give an approximation of the proportion of the output coming from open-cut operations.

The data are based on production figures for 1925, during which the total production, according to the American Bureau of Metal Statistics, was 3,175,000,000 lb. In the case of Nevada Consolidated, United Verde, and Phelps Dodge, both open-cut and underground methods of mining are used, the segregation of the total output being only roughly estimated in this table. United Verde did not produce as much as one-fifth of its copper from steam-shovel mining in 1925, but the proportion probably has increased since.

Incidentally, it may be pointed out that some of the companies that produce copper at the lowest cost per pound as well as per ton of ore are not "shovel" mines. Caving methods of mining as developed in recent years give remarkably low costs in many instances.

| Company | Millions of Pounds | Company | Millions of Pounds |
|---|---|---|---|
| Chile | 220 | New Cornelia | 70 |
| Utah | 215 | Rio Tinto | 25 |
| Phelps Dodge (a) | 50 | Miscellaneous | 25 |
| Union Miniere | 198 | | |
| Chino | 70 | Total open-cut | 933 |
| United Verde (a) | 20 | Total all mines | 3,175 |
| Nevada Con (a) | 40 | Percentage open-cut | 29.5 |

(a) Both open-cut and underground operations.

# News of the Week

## Summary

*RECENT GOLD DISCOVERY in New Guinea—Indian Copper Corporation launched—East Geduld initiates development program.*

*Five gold mines operating in India—Rand gold production 9,962,852 oz. in 1926; native labor decreasing.*

*Denouncements in Mexico increasing; copper production somewhat restricted; extension granted for redemption of silver coins.*

*Philippine gold mines produce $1,500,000 in 1926; 7,000-ft. tunnel planned by Benguet Consolidated.*

*Rico plant treating 250 tons daily—La Bajada Copper developing New Mexican property.*

*North Lily discovery stimulates East Tintic—Efforts to revive mining at Aspen, Colo.—Arizona plans home for aged miners.*

*Satisfactory progress on smelter for Noranda mine—Hollinger closes option on lead property—Ontario gold mines show slight decrease in January production.*

*Manganese studies by U. S. Bureau of Mines require funds for continuance—Oil-shale investigations planned for another year.*

*Canadians hold 54 per cent of Dominion mining shares; citizens of United States 30, Great Britain 13.*

*Pickands-Mather opens new mine at Bovey, Minn.*

### Tungsten Mines Near Mill City, Rochester, and Lovelock, Nev.

The Nevada-Massachusetts Co., Inc., is a reorganization of the Pacific Tungsten Co. and has operated the property of the latter company for the past two years near Mill City, Nev. The mine is 8 miles northerly from Mill City. When the property was reorganized there was little available tungsten ore, but exploration work resulted in the finding of the continuation of the tungsten lead, and the main working shaft is now being sunk to the 500 level and stoping operations will be started on this level.

Electrical power from the Lahonton dam is being used at both mine and mill. Concentrates to an amount equivalent to about 1 per cent of tungstic acid in the ore are recovered. The grade of the concentrate is high, reaching upon the last shipment 76.7 per cent tungstic acid. The presence of pyrite in the scheelite ore necessitated its separation from the scheelite concentrates by a magnetizing roast and the use of Wetherill separators.

At Rochester, the Rochester Silver Corporation is still involved in lawsuits, and the property is idle. It is expected that the difficulties will soon be settled and the property operated by former leasers. The Osage Mining Co. has constructed a mill and is developing the Looney-Gilbert area, near Rochester. C. W. Poole worked over the tailings at the Nightingale tungsten mine, 30 miles out of Lovelock, and recovering some tungsten.

The White Bear Syndicate is working the Dun Glen mine, about 15 miles easterly from Mill City, and has constructed a ten-stamp amalgamation mill. At Seven Troughs a long adit is being driven to tap the Seven Troughs mine at depth. Near Oreana the Champion Spark Plug Co. is mining a deposit of dumortierite and shipping the crude mineral to Detroit. Near Antelope Springs, 30 miles east of Lovelock, W. G. Adamson is developing a mercury deposit and is planning the installation of a quicksilver furnace.

### Albany Iron Mine Operates Four Years Without Accident

OPERATING four years without one disabling accident is the remarkable record at the Albany mine of the Pickands-Mather Co., three miles east of Hibbing, Minn. During this time a great deal of dangerous work was completed. Over 500,000 tons of loose rock was removed where it was necessary to operate against a forty-foot bank with standard railroad-type shovels, half of the work being done on night shift. A unique scheme of floodlighting the pit was installed in addition to floodlights on the shovels, and this illumination proved so satisfactory for both safety and efficiency that it has been adopted by other pits on the range. The annual shipments average about 200,000 tons.

### Newfoundland Wins Boundary Suit

Boundary litigation covering a period of more than twenty years between Newfoundland and Canada has come to a close. The Judicial Committee of the Privy Council on March 1 gave judgment by which 110,000 square miles of Labrador is awarded to Newfoundland. The territory won in this suit is rugged, sparsely settled, and contains vast timber areas and great mineral possibilities. The value of this claim as set forth in the suit is $250,000,000. Sir Patrick McGrath, was responsible for the assembly of the material for the case.

### Interstate Lead & Zinc Co. Results From Merger

The merger of four mining companies of the Joplin-Miami district into one $4,000,000 concern was completed at Kansas City Feb. 22. The new concern will be known as the Interstate Lead & Zinc Co., and it will be headed by R. M. Atwater, Jr., of New York, as president. Those companies merged were the Cherokee Lead & Zinc Co., the Oklahoma Woodchuck Mine Co., the Hutcheon Management Co., and the Meteor Lead & Zinc Co. The Cherokee mine is northwest of Treece, Kan.; the Woodchuck mine a few miles south of Cardin, Okla., and the Meteor mine southwest of Picher, Okla. The Hartley mine, being operated by the Hutcheon Co., is a short distance southwest of Baxter Springs, Kan.

Interstate Lead & Zinc plans to build a modern plant on the Cardin lease in 1928 and another on the Hartley property in 1929. A bond issue of $2,500,000 has been authorized, $1,000,000 of which will be used to cover immediate improvements and the remainder to be held in escrow for obtaining new leases and developing new plants.

C. F. Dike, of Joplin, will be vice-president and general manager of the Interstate company, L. M. Wicher, vice-president of the United Verde Extension Mining Co., will be treasurer. Other members of the board of directors will include H. Gibbs, who was president of the Hutcheon company, and J. P. Heffernan, of Heffernan & Henault, contractors, of Montreal, Can.

### C. & H. to Open Fourth Shaft on Osceola Amygdaloid

The Calumet & Hecla Consolidated will reopen No. 16 shaft on the Osceola amygdaloid lode at Calumet, Mich. This will make the fourth unit in operation on this vein. The shaft and the rock house will be given attention at once,

but repairs will be of minor character, as the mine is in good condition. The shaft has been idle for years.

Nos. 13, 14 and 15 shafts are producing a total of approximately 1,000,000 lb. of refined copper per month from the Osceola formation, the rock carrying from 20 to 22 lb. of copper per ton. Labor conditions are favorable for an extension of operations.

At Calumet & Hecla Consolidated's Cliff exploration, in Keweenaw County, Mich., preliminary work is well under way. No. 1 shaft has been pumped out and timbering is proceeding. Old timber sets will be replaced. The three old shafts will be used in development work, No. 1 as a supply shaft. All pumping will be done from No. 1. Installation of the surface plant is about completed.

In its dividend-paying days the Cliff operated only a fissure vein, little or no attention being paid to regular formations. It is characteristic of the district that fissure veins enrich the amygdaloids, Ahmeek being a case in point. The fissure in No. 2 Ahmeek, enriched the Kearsarge, and there are similar conditions in other mines. Calumet & Hecla will proceed upon this theory at Cliff and investigate the regular formations along the fissure.

## Keweenaw Annual Meeting March 14

The annual meeting of the Keweenaw Copper Co. will be held at Calumet, Mich., on March 14. All acts and proceedings of the board of directors during the past year will come up for consideration, approval, and ratification. This includes the granting of options on mineral lands and the Keweenaw Central railroad to Calumet & Hecla Consolidated.

## Franklin Assessment 50c.

Franklin Mining Co.'s assessment of 50c. per share was payable Feb. 21. The mine, near Hancock, Mich., is well equipped for any exploratory or development program that may be undertaken. No plans of this character have been announced. The most recent operation was the sinking of a shallow shaft to examine the Kearsarge lode, values in which proved mediocre. Both the Pewabic and Allouez veins have been developed at depth in Franklin. The best showing appeared in the Pewabic at a depth of 3,300 ft. in No. 2 shaft.

## Northwaite Mining Incorporates

Northwaite Mining Co., Ltd., holding claims immediately north of the Waite-Montgomery mine, in northwestern Quebec, has been incorporated under a Quebec charter with an authorized capital of $2,000,000, divided into shares of $1 par. The property consists of about 880 acres. A block of 300,000 treasury shares has been underwritten, and this is being disposed of privately at 25c. a share. The directors of the company are Charles H. Ackerman, Peterboro, Ontario; Fred M. Connell and J. H. Waite, mining engineers of Toronto; James Parker, Toronto, and Thomas Montgomery, prospector, of New Liskeard.

## Mass Consolidated Sells Stamp Mill

Mass Consolidated Mining Co.'s stamp mill at Keweenaw Bay, Mich., has been sold to Houghton men, who will dismantle it. The sale also includes twenty-three houses, mill site and stamp sand deposit. The mill is a steel structure, 90 by 210 ft., with two stamps, jigs, and four Wilfley tables. It became useless so far as Mass is concerned when the railroad bridge over the Firesteel River on the branch line between the mine and mill was condemned and taken down. Inasmuch as Mass is a small and high-cost producer it is doubtful whether it will be reopened, unless copper goes to a much higher figure.

## North Lily Discovery Stimulates East Tintic

Interest in development activities in the East Tintic district near Eureka, Utah, has been increased by the announcement that the United States Smelting, Refining & Mining Co. will develop the Central Standard Consolidated Mines property through the Copper Leaf shaft. In consideration of providing funds for development of this property, the U. S. Smelting company has been given an option to purchase 300,000 shares of treasury stock and a substantial block of private stock.

Over $300,000 has already been spent by the Central Standard in sinking two shafts and equipping the property with electrical machinery. The property of the Central Standard, consisting of the Copper Leaf and the Central Standard, lies immediately north and east of the North Lily of the International Smelting Co.

Drifting is to start from the 900 level of the Tintic Standard Shovel mine to explore the North Lily and Eureka Lily on this lower horizon. The course of this heading will roughly parallel that of the drift on the 700 level. A bond and lease has been taken by the Tintic Standard Mining Co. on the Big Hill group. The International Smelting Co. has recently exercised its option to purchase control of the Yankee Consolidated group, from which it has conducted extensive operations.

## Aspen, Colo., May Be Revived as Mining Camp

Utah capital, headed by W. F. Snyder & Sons, will take an important part in an enterprise having for its objective the revival of Aspen, Colo. Properties of D. R. C. Brown have been acquired on long-term leases and option to purchase by W. F. Snyder & Sons, who turned these holdings over to the Continental Divide Development Co., of Colorado. J. C. Synder and W. F. Snyder, of Salt Lake City, were elected to the directorate of the company.

Operations will be conducted through the 4-mile Cowenhoven electrically equipped tunnel with the view of opening up the back or lower contacts productive in Leadville, Red Cliff, and Gilman on the same mineral system. All of past production at Aspen has come from the Leadville limestone of Carboniferous age, while the other contacts, ranging from Carboniferous in the geologic column to the Paleozoic, have not been systematically explored.

J. C. Jensen, a director of the Combined Metals Reduction Co., will be in charge of operations and D. P. Rohlfing will act as consulting geologist.

## Gold Circle Mill Ready March 15

The Gold Circle Consolidated Mines Co. mill at Midas, Nev., will be ready for operations about March 15, according to Noble Getchell, president of the company. When operations are in full swing, the population of this long-deserted camp should increase to 500. At present, there are 350 people at Midas.

Enough ore has been blocked out, according to Mr. Getchell, to supply the mill with 100 tons daily for two years. Chief supplies will be drawn from the Missing Link and Grant mines.

## Pickands-Mather Opens New Mine at Bovey, Minn.

The Pickands-Mather Co. has transferred a Model 300 Marion shovel from the Dunwoody mine, at Chisholm, to the Orwell mine, at Bovey, Minn., where stripping operations will start this spring. This property was taken over by the company when the Todd Stambaugh company went out of existence. The Orwell consists of five forties and has available over 6,000,000 tons of ore. When this stripping is completed a pit approximately three miles long will extend between Coleraine and Taconite and will take in a majority of the producers in that district.

## Home for Aged Miners May Be Built in Arizona

If a bill before the Arizona State legislature becomes a law, 50,000 acres of state land will be sold to provide funds for the erection of a state hospital for old and disabled miners. The bill has already been approved by the senate committee of the whole.

The hospital is to be constructed at Hot Springs Junction, some 50 miles north of Phoenix on the line of the Santa Fe Railroad. The hot springs have long been known for their curative powers. Prospective beneficiaries must have been citizens of Arizona for at least twenty-five years, and Superior judges are to determine their eligibility for admittance to the hospital, rather than the board of directors of state institutions.

## Movakan Mill Ready April 15

The Movakan Mining Co. expects to have its new mill on the Buchanan land, northeast of Joplin, in the Joplin-Miami field, completed by April 15. It would have been in operation sooner, but a strong flow of water interfered. A new pump was installed, and dewatering is now no longer a problem. Drifts are being cut at the 140 level, with excellent ore showings. Movakan's property is one of the few new mines to be developed in the Missouri section of the district in several years.

## La Bajada Copper Shaft 40 Ft. in Ore

Recent developments on the porphyry properties of La Bajada Copper Mining Co., Santa Fe, N. M., are attracting attention of mining men and engineers familiar with geological conditions and mine operations in that section. The orebody encountered at 105 ft. in La Bajada shaft has now reached a depth of 145 ft., all in ore, with no bottom in sight and neither the length nor width as yet determined. The management expresses much satisfaction with conditions in general and particularly with the grade of copper ore exposed.

The affairs and development of La Bajada properties were conducted from May, 1923, to September, 1925, with funds made available by the originators of the enterprise. Since October, 1925, the company's operations have been financed through the sale of a limited amount of treasury stock to their friends and associates. The sole aim of the company's officials is to attain actual results in what they regard as a valuable and promising mineralized acreage.

## Rico Plant Treats 250 Tons Daily

The Rico (Colo.) flotation plant of the International Smelting Co. is now treating about 250 tons of ore daily. Mill feed is coming from the Rico Argentine, the Silver Swan, the Shamrock, the Falcon Lead, and the Rico Reduction mines. International Smelting recently completed a bunk house capable of accommodating 75 men. The Rico Reduction Co. is installing a 2,300-gal. plunger-type pump, after which sinking of its shaft, now down 300 ft., will be resumed.

## Katherine Gold Making Good

The Katherine Gold Mining Co., Kingman, Ariz., is opening up larger ore reserves. The shaft is 560 ft. deep and in the vein practically all the way. It is understood that sinking will be continued at least another hundred feet in the near future. The mill is reported to be treating about 270 tons a day of good average ore, with regular shipments of gold bullion to the San Francisco Mint.

## Abitibi Developing Gold Property

Abitibi Mines, La Reine, Quebec, operating in the Lightning River district of northern Ontario, has ordered a mining plant and will resume active development. The immediate objective is to continue shaft sinking to the 500 level. The main fault zone with a definite fault-plane structure strikes through the center of the property and has been proved to a depth of 400 ft. and a length of 600 ft.; and the length indicated on the surface is several thousand feet. This zone has been tested by diamond drilling and carries an appreciable gold content. Widths cut on the several sections of this shear zone are from 7 to 28 ft. and average 16 feet.

## Noranda Progress Satisfactory

Noranda Mines, in the Rouyn area of Quebec, is making satisfactory progress in the erection of its smelter, the work on which is now ahead of schedule. Officials of the company are hopeful that it will be ready for operation by November of the current year. Underground work has been delayed, as efforts were concentrated on the completion of the smelter. The principal operation has been the enlarging of the shaft, which is being made a three-compartment one to the 300 level. Shaft sinking to the 600 level is to be resumed soon. On that level the company plans to install equipment so that ore can be hoisted from all the levels above, while the shaft is being deepened to the 1,000 level. A new compressor is now on the property, and by April air for twenty-five drills will be available. A new hoist has been ordered and is now on its way to the property.

*Flotation plant, International Smelting Co., Rico, Colo.*

## Hollinger Closes Option on Lead Property

Active prospecting is being carried on in the recently discovered lead area of Black Township in northern Ontario. Hollinger interests have made the first payment on the $100,000 deal for the discovery group, and plan diamond drilling at an early date. The Nipissing has completed an examination of claims held under option adjoining the discovery group. A factor regarded as important is the occurrence of a wide area of slate formation which resembles that occurring in the Chelmesford section of the Sudbury district, where extensive lead-copper-zinc deposits are being opened up.

## Canadians Hold 54 Per Cent of Dominion's Mining Shares

Addressing a meeting in Toronto, Ontario, recently, Dr. J. Mackintosh Bell stated that Canadians derived the greatest financial benefit from their own mineral resources. He said that 54 per cent of the shareholders in Canadian mines were Canadians; 30 per cent Americans; 13 per cent British, and 3 per cent citizens of other countries. Dr. Bell regretted that British capital was playing such a small part in the Canadian mining industry. However, he said there were real signs of increasing interest in Great Britain, and he thought that they were realizing that, despite some inevitable fiascos, the Canadian mines were making vast strides. Discussing the mining situation in general, Dr. Bell said: "No one can say how many new Cobalts, new Porcupines, or new Kirkland Lakes may be found, but we can confidently expect great developments from time to time, which will play an important rôle in the future of the country."

## Canada Cement Co. to Develop Gypsum Mines

Announcement that the Canada Cement Co. will soon start extensive gypsum-mining developments on the north side of Antigonish harbor, Nova Scotia, has been made by E. N. Halton Fyles, geologist, of Montreal, who has been making a study of the areas in the Antigonish district for some time. Mr. Fyles made a previous examination of the areas in 1910 for a different company, but development was abandoned owing to lack of shipping facilities. In the meantime the harbor has been dredged sufficiently to warrant the establishment of a shipping plant, and it is expected that within a year or two the docks will take a ten-thousand ton steamer at low tide. Twenty-four properties have been taken up by the company, and work will start as soon as the frost is out of the ground. Construction work will include shipping piers, storage plant, a crusher, and railway lines to the quarries.

## Development Progressing at Central Manitoba

H. A. Wentworth, president of the Central Manitoba Mines, Ltd., recently predicted that October next would see the first shipment of gold bullion from the company's property. Development work at the mine is now in full swing, and equipment for the cyanide mill is being conveyed to the site from Great Falls, from which point a power line 50 miles long is being erected at the mine. About 300 men are now employed.

# Philippine Gold Mining in 1926

## Benguet Consolidated Produces $1,250,000 and Develops Additional Reserves—Activities of Other Gold Mines and Districts

By C. M. Eye
San Francisco, Calif.

METAL mining in the Philippines, other than for gold, was, as heretofore, negligible in amount in 1926. Silver was a byproduct from gold bullion. The Benguet district led, as it has for many years past, in gold production, the chief producer being Benguet Consolidated. This property, which produced one and one-half million in 1925, yielded over one and one-quarter million in 1926. Production for the entire district will probably reach $1,500,000 for the year.

At the end of 1925 the Consolidated had ore reserves insufficient to last for a year at normal rate of production, and apparently the orebodies were bottomed, so the possibility of an early liquidation was seriously contemplated, but developments were so favorable during 1926 that by the end of the year there was in sight over 80,000 tons of $16 ore, or sufficient for one year's operation at the present rate of about 220 tons per day. More important than this, diamond drilling below the No. 6 level demonstrated the presence of pay ore at from 170 to 410 ft. below that level, which is the lowest thus far opened. This ore is of an entirely different character from that of the upper orebodies, where it is principally quartz and pyrite, with opaline silica in abundance, the gold being associated with the pyrite.

The following is an analysis of a representative sample of the drillings:

| | Per Cent |
|---|---|
| Silica | 59.30 |
| Alumina oxide | 1.41 |
| Iron | 3.65 |
| Calcium oxide | 8.97 |
| Sulphur | 7.26 |
| Copper | 0.02 |
| Tellurium | Nil |
| Combined water | 19.39 |

Based on the chemical analysis, Alfred Stickney made the following approximate analysis by minerals:

| | Per Cent |
|---|---|
| Quartz | 51.8 |
| Opaline silica | 11.0 |
| Pyrite | 7.6 |
| Gypsum | 18.0 |
| Calcium aluminum silicate | 9.0 |

The gold appears to be entirely uncombined, very pure, and often crystalline. Experiments show that it dissolves quickly in cyanide solution. One band of an inch or so in width, encountered in the deepest hole, assays from $15,000 to $18,000 per ton. Alongside of this is a width of two feet of ore of the same character, assaying $325 per ton. Gypsum and anhydrite are strongly in evidence in connection with this lower ore occurrence, which is 1,170 ft. below the outcrop.

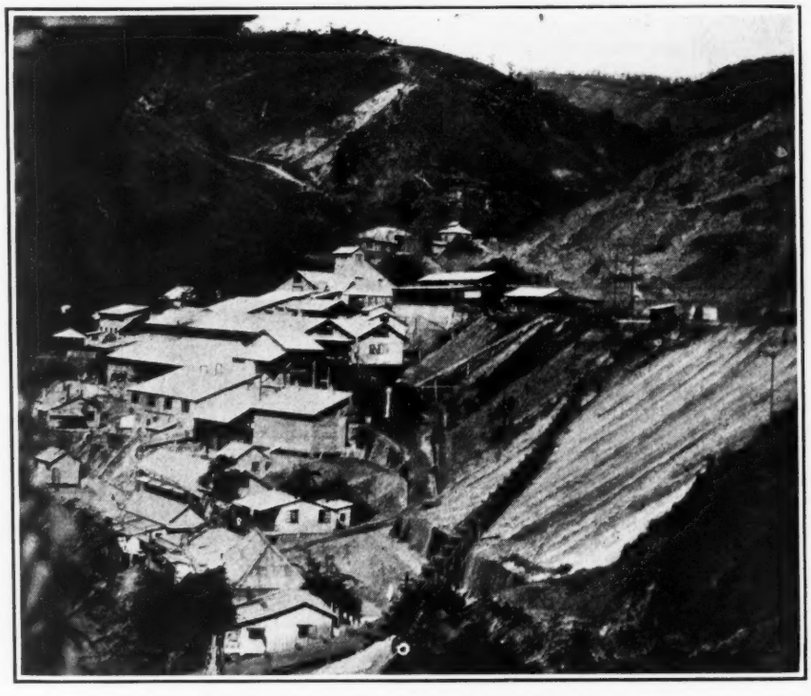
A start was made toward sinking the working shaft to reach this body of ore, but after it had progressed 42 ft. below No. 6 level, the failure of a 1,000-gal. station pump on the No. 4 level and the failure of the standby pumps to handle the water (amounting at that time to over 1,200 gal. per minute) caused the mine to be flooded to No. 5 level, where it is now being held.

Development to the westward in the direction of the rake of the shoots on Nos. 3, 4, and 5 levels and into the hanging wall on these levels has demonstrated the continuation of the upper orebodies to the westward and the presence of lenses of pay ore in the hanging, so there is every reason to believe that during 1927 as much ore will be developed on these levels as normal production requires, thus maintaining the ore reserves at the present figure for another year.

### Seven Thousand Foot Tunnel Proposed

It has been definitely decided to drive a drainage tunnel from a point near the No. 2 power plant a distance of about 7,000 ft. through hard rock, the first 4,000 ft. through granodiorite, and the remainder andesite until the lode is reached. This work will be done with modern machinery for fast driving, and should be completed before the end of 1928. It will provide drainage to a point about 670 ft. below the collar of the present working shaft, and will make it possible to develop the deep-seated ore. It is quite likely, however, that a new working shaft will have to be raised to the surface some distance to the westward of the present one, as the old shaft is in the zone of possible subsidence and is equipped with cages and a hoist that has about reached the limit of economical service. Though a new shaft in the location indicated will necessitate provision for ore transference some distance to the mill, it will probably be better located with reference to the position of the lower orebodies, can be better equipped for handling ore, and will be in a much safer location. The old shaft will then serve for handling men and timbers, for power lines, and other purposes, and possibly for handling water from deeper levels to the drainage tunnel. This latter, by the way, should serve as a haulageway for waste.

During the latter part of 1926, a considerable amount of work, including a vertical diamond-drill hole 1,000 ft. in depth, was done on the Gomok ground, but with negative results, as regards discovery of pay ore. The work is being continued, however, in the hope of finding something worth while. The financial position of the Consolidated and the physical condition of its plant are both excellent, and the prospects for a fairly long period of activity are good.



*Mill of the Benguet Consolidated Gold Co.*

Another development of significance was the opening up of two shoots of ore of good width, length, and excellent grade on the No. 4 lead of the property of the Balitoc Mining Co. (formerly known as the Acupan Mines). The work was done on several successive levels, and the results are sufficiently important to move this property from the prospect stage to the potential mine class, and apparently warrant the completion of the lower working crosscut tunnel to intersect both the No. 1 and the No. 4 lode. There are some metallurgical difficulties to be overcome, due to excessive acidity of ore.

Development work was continued on

the property of the Itogan Mining Co., until a milling plant was warranted, when the old Headwaters plant was purchased and removed to the property and most of it re-erected. There is a 10 by 16 in. Hercules rock breaker, seldom used, as the most of the ore is very soft, consisting largely of black manganese. The harder portion is mainly vein calcite, though considerable quartz is found in portions of the lode. There is a 6-ft. Hardinge mill, in closed circuit with a Dorr simplex classifier, the overflow going to a Frenier pump, which lifts it to the level of the low Pachucha tanks, three in number, operated intermittently.

A Pelton waterwheel was installed, and supplemented by the addition of a Skandia two-cylinder, marine-type semi-Diesel engine. The rainfall for 1926 in the district was only about 40 per cent of normal, so the water-power failed early in the fall, and since then there have been numerous shutdowns, owing to breakages in the engine. The normal capacity of the plant when running is about thirty-five tons per day. Extraction is said to be good, but the loss in dissolved values is high, owing to lack of facilities for proper washing. Five of the ten stamps from Headwaters have been erected, but have not been put in operation as yet. There is a noticeable lack of facilities usually considered necessary to successful operation, such as assaying and melting equipment, facilities for making repairs, and stocks of supplies and repair parts, but these will no doubt be provided in time, if the enterprise can successfully weather the present stage.

### Other Properties

Another Benguet producer, though on a very small scale, is the property of a Mr. Douglas, an employee of the Consolidated. This contains a small but high-grade vein, little developed as yet, the values being almost entirely in iron pyrite. The property has an arrastra, driven by an overshot wheel, all built on the ground, which has been recently put in operation. A representative sample from several hundred pounds of concentrate panned from the ground material assayed $1,380 per ton. It is the intention of the owner to put in canvas tables and possibly a concentrating table.

D. Kleinfelter, another employee of the Consolidated, is opening up a deposit on his property. He is driving on the hanging-wall side of a large altered dike of acid character (probably syenite) with a width of seven feet or more, showing little mineralization and with little free gold in evidence, but nevertheless assaying around $15 per ton. The only mineral apparent in panning is iron pyrite.

The Ukap Mining Co., a Hongkong concern owning a group of claims to the west of the Bua group, did considerable development work on several calcite-manganese leads early in 1926, but has apparently gone as far as it can, after trying a small mill, with a limited tonnage of only fair-grade ore in sight, too small to warrant the installation of a treatment plant.

The Headwaters property has apparently gone into the class of abandoned mines. This mine was also financed in Hongkong, and was owned mostly by Hongkong men.

The Comote mine is in the class of abandoned mines at present, though Tex Reavis, the pioneer prospector of Benguet, who worked the Comote in a small way, is back on the property and endeavoring to get some sort of cheap plant erected whereby he hopes to mill ore from such small manganese stringers as he can find.

The Kelly property was worked quite extensively during 1926, by Igorotes, under an arrangement with the owners, and it is commonly believed that as much as $100,000 was taken out from bunches and stringers of good ore by primitive methods. There was also considerable activity in Igorote mining in a locality several miles north from the Headwaters property, and finds of very rich ore were reported, but it was apparently limited in quantity. Nevertheless, the amount of gold produced from Igorote operations in the district seems to be on the increase.

In the Aroroy district, in the Island of Masbate, the syndicate which is operating there continued its activities throughout the year, but apparently on low-grade ore, and with little or no margin of profit. The owners plan to do extensive diamond drilling during the first half of 1927. The only other producing property in the Aroroy district was that owned by Geringer and Schwab, which is equipped with a small stamp mill. It is an antigua, the only property in the islands so far as known where milling was done in ancient times. Here was a tailings dump, which was first worked through the mill, and then the mine was opened up, and milling has been profitably continued on the stope filling and material from the stope walls. This is not high-grade, but is easily mined and milled, making the operation profitable in a small way. No definite figures are available on the total production for the Aroroy district, but it seems likely that it will fall below that for 1925.

## Montana Notes

North Butte Mining Co. is installing a 10-in. water column from the surface to the 1,200 level in its Main Range property in the eastern portion of Butte. It is also installing a pipe from the 2,200 to the 1,200 level. Between the Granite Mountain shaft and the company's north sideline, a distance of 2,400 ft., a number of attractive looking veins are showing on the surface. In January leasers shipped about 3,500 tons of ore.

The Zonolite Mining Co., producing a new type of fireproofing material, near Libby, Mont., is increasing its output, and its officials expect soon to put on an extensive advertising campaign, describing all of the company's different products and the specific uses to which they are adapted.

What is regarded as an important strike is the opening of ore 12 ft. wide in the south portion of the 200 level of the Otisco mine, in the south-central portion of Butte, Mont. The property is being operated under the supervision of Glenn Anderson, mining engineer.

# Toronto Letter

*By Our Special Correspondent for Northern Ontario*

## Ontario January Production Shows Slight Decline—McIntyre Shaft Nears Completion

During January of 1927 northern Ontario gold mines treated 343,180 tons and recovered $2,527,262, an average of $7.37 a ton, a small decrease as compared with the preceding month. Porcupine mines treated 292,484 tons and recovered $1,926,908, an average of $6.58 a ton. This represents a decrease of approximately 50c. a ton. Kirkland Lake mines treated 50,696 tons and recovered $600,354, an average of $11.87 a ton. This is a decrease of 2,200 tons and $118,000 in total values as compared with the record for the preceding month.

February production of the Keeley mines, of South Lorrain, amounted to 124,956 oz. of silver and 11,000 lb. of cobalt. No outstanding developments of importance occurred during the month.

Nipissing has ordered a five-drill compressor and other equipment for shipment to its property in Montbray. The plant will be steam driven, but may be converted to electricity later on.

The new shaft of the McIntyre mines, Porcupine, has reached the original objective of 4,000 ft. and is being continued 150 ft. further to make allowance for loading pockets and sump. The work consumed 692 days' working time, with an average of seventeen shaft men per shift, and included the cutting of 19 stations and 600 ft. of station crosscutting. A total of 180,000 tons of rock and 40,000 tons of water were handled, and the timbering used 2,000,000 board-feet of timber and 300 cords of cedar filling. The best time for any one thirty-one days was 250 ft. It will probably be several months before the shaft is in regular operation.

On the Kamiskotia Copper property, about 20 miles northwest of Porcupine, which is under option to the Hollinger, bunk-house accommodations are being put up for forty men, and a plant with which to sink a shaft is being sent in. Hollinger now has eight diamond drills working in this section and should soon be in a position to know whether the payment due in March will be made. There is a good deal of activity throughout the district, and the Hollinger, in addition to the original Jamieson discoveries, is taking up other properties.

The shaft of the Teck-Hughes mine of Kirkland Lake has encountered high-grade ore on the 16th level, which is at a depth of 1,855 ft. A width of at least 20 ft. is indicated, with a grade understood to be over $25 a ton. This is the same vein encountered some time ago on the 15th level, where 12 ft. of ore was found averaging $40 to $50 a ton. A new mill has been started and is now handling 150 tons a day. Sinking is being continued to the 19th level, and soon after this is completed the new mill will be in a position to handle 300 tons of ore a day. In the mean-

time the old mill is being operated on ore drawn from the upper parts of the mine.

Developments at the Wright-Hargreaves continue to be favorable, and on the 1,375 level $15 ore is being encountered. This development is on the south vein, which at 1,250 and 1,375 ft. is much higher grade than the upper levels. Wright-Hargreaves has the enviable reputation of having returned 112½ per cent in dividends in a little more than five years.

KIRKLAND LAKE BELOW ESTIMATE

The annual report of the Kirkland Lake Gold Mining Co. covers only three months of production, during which time the recovery was $126,999, an average of $11.73 a ton. This is considerably less than the estimate of $20 given to the ore reserves a few months ago, but is sufficient to enable the company to make a substantial profit. During the year $210,000 was spent, practically all of which was for development work. On Jan. 1, net cash assets amounted to $148,223. Officials of the company speak most encouragingly regarding the possibilities and apparently expect an improvement in the grade.

The directors of the Gold Hill mine, Haileybury, Ontario, with a property in the Kirkland section, have decided to build a mill with a capacity of 100 tons a day. A new electrically driven mining plant has been installed within the last few weeks, and sinking is to be continued from the 800 to the 1,000 level. Contracts have already been let for machinery for the new mill.

## Quicksilver Production in Washington

During 1926 there was produced 489 flasks (net weight 36,755 lb.) of quicksilver in the State of Washington. This metal was recovered by the Barnum & MacDonell Mercury Co., Morton, Wash., from 900 tons of ore treated in a Johnson McKay 12-tube retort. Three tons per day was the average amount treated, producing 40.84 lb. per ton.

The mine is opened on two levels with connecting raises. Development work is in progress on the third level. The total underground work is about 1,600 ft. of drifts and 480 ft. of raises. All of the ore produced so far has come from the drifts and raises, none coming from stopes.

No estimate of reserves has been made, as sufficient development has not yet been completed upon which to base calculations. The company owns 157 acres where the mine is located, and has a lease on 320 acres of land adjoining, and an option on 160 acres near by.

## Denn Shaft Operating Full Time

Operations at the Denn shaft of the Shattuck-Denn mining Co., which were discontinued when the new large air compressor blew up recently, have been resumed. No sinking in the shaft has been done since Jan. 1. The shaft is now down to a depth of 1,870 ft. It is proposed to sink the shaft to a depth of 2,000 ft. before the development campaign is completed.

# Mexico City Letter

By W. L. Vail

*Special Correspondent*

## Denouncements Numerous—Copper Production Restricted—High-Grading on the Increase

The annual report of the Mexican Mines of El Oro is not very satisfactory. Though dividends of £2 6d. and £1 6d. were paid during the fiscal year, the possibility of continuing work appears to depend on the quantity of ore in place. Efforts to discover new bodies of ore have proven expensive and delusive. Mineral reserves are reported to be practically exhausted. The cost of production during the year was reduced to $1.33 per ton and assays averaged $8.04 in gold and 6.40 oz. of silver. The original capitalization of these properties was £210,000, and dividends have been paid amounting in all to £2,355,000.

PEÑOLES ABANDONS EL DOCTOR

The Peñoles company is reported to have quit work and surrendered the working option on El Doctor mines, near Queretero. These mines are the property of the Braniff family. Several attempts have been made to bring them into production, but the character of the ore and distance from transportation make profitable operation difficult.

Engineers from the Peñoles company are now in Oaxaca examining the Conejo Blanco, with the possibility of taking that property under a working lease. This mine is in the Tavichi district.

Representatives of the American Smelting & Refining Co. deny rumors that they have any intention of closing the smelter at San Luis Potosi or of materially reducing the force there.

The Mercurio Mining Co., Zacatecas, reports as a result of recent development work an accumulation of about 300,000 tons of ore assaying 0.55 per cent mercury. Also from Zacatecas comes the information that new machinery is being installed to treat an increased output at the Bote mines; that improvements are being made at the Veta Grande mill; that the Peñoles is spending a large amount of capital on the development of mines, erecting of machinery, and other complementary work and that the mill and mines at La Fe, a short distance from the city of Zacatecas, are being put in condition for increased production.

The two American graphite companies now operating in the State of Sonora estimate that they will produce about 6,000 tons of graphite this year. Their entire output goes to the United States.

HIGH-GRADING IN CHIHUAHUA

The Chihuahua Mining Chamber is much exercised over the rapid increase of "high-graders" and is urging the state government to take measures to put a stop to disposing of stolen ores. Some years ago this evil became so serious that the civil authorities combined with the federal troops and effectively put a stop to the practices. Recently troops have been withdrawn from many of the mining camps and the thieves have resumed their operations. Similar complaints come also from the bordering states of Sonora and Coahuila.

It is reported that the Guggenheim interests have recently expended over 17,000,000 pesos at their coal properties in Rosita, Coahulia, where many miners are employed. A modern town site has been created and an exceptionally good year is anticipated by the company.

H. Moran has recently taken over a number of properties in the Gigante Mountains, near San Nicolas del Oro, Guerrero, from General O. Yokoyama, representing a Japanese syndicate. The properties are between Tepantillan, San Nicolas del Oro, and Jamotle. Mr. Moran is constructing a 50-ton mill.

The General Mines Corporation, organized in the United States to take over and operate on a large scale an important group of mines in the Guanecevi district, State of Durango, and to construct railways and hydraulic powers, is submitting for public consumption a $500,000 bond issue. A railway is proposed to connect with the Tepehuanes branch of the National Lines, now operating north from Durango. General L. D. Ross, late of the British army, is president of the company and active in the management.

DENOUNCEMENTS INCREASE

Activity in mining denouncements has increased somewhat during the last six weeks, caused probably by the fact that many properties have been declared forfeited by the government because of failure to pay taxes. A number of concessions have also been issued recently to work tailings of abandoned properties, and old dumps, for the recovery of gold, silver, and quicksilver.

According to a circular issued by the Department of Mines, the registry for mining titles issued since Aug. 1, 1926, has been opened, and all owners of titles are advised that the same must be entered on or before the first day of August, 1927, under penalty of forfeiture.

Most of the copper properties of the republic are holding themselves down to minimum production, by agreement with the companies operating in the United States, to avoid overproduction. An exception is the Boleo company, of Lower California, which exports its entire product to Europe, and is increasing output to the fullest capacity.

EXTENSION GRANTED FOR REPEMPTION OF SILVER COINS

A new extension has been decreed for the term set forth for the circulation and exchange of those silver coins of which circulation is to be prohibited. From Aug. 1, 1927, all silver currency not having marked thereon "0.720" will not be allowed to circulate. Up to Oct. 31, 1927, the Bank of Mexico and its branches, and the Federal collecting offices and subordinate offices, will change at par the coins that are discontinued for those having 0.720 marked thereon. Advice is given that all post offices and stamp-tax agencies are obliged to make this exchange when called upon to do so.

# News From Washington

By PAUL WOOTON
Special Correspondent

## Bureau of Mines Manganese Studies an Aid to Producers – Low-Grade Reserves Available – Oil-Shale Investigations

THE second deficiency bill, which doubtless will have been enacted into law when this appears in print, carries an appropriation of $25,000 for the continuation of experiments, under the direction of the U. S. Bureau of Mines, on manganese ore at Minneapolis. Director Turner of the Bureau of Mines told the appropriations committee of the House that the results which have been obtained in connection with the operation of the experimental blast furnace are such as to promise developments of great commercial importance. Mr. Turner explained to the committee that the production of steel in the United States requires approximately 800,000 tons of manganese ore annually, of which in recent years the United States has produced only 50,000 tons. As the United States possesses very large resources of low-grade manganese in the form of manganiferous iron ores and ferruginous manganese ores, Mr. Turner pointed out the possibilities of our becoming less dependent upon foreign sources of supply. In addition to the low-grade ores of the Cuyuna range of Minnesota, there are other large deposits in New Mexico, Georgia, Colorado, and Michigan, he told the committee. He also called attention to the large low-grade occurrences of the silicates and carbonates of manganese which are found in Washington, Montana, and California. Development of these low-grade ores, he said, is not only of industrial importance but also of strategic value in case of war-time emergencies.

Members of the committee insisted upon knowing why the steel industry did not undertake this research for itself. Mr. Turner did not attempt to suggest the reason, but pointed out that the fact remains that no material work is being done and that a very large amount of manganese is being wasted through inability to recover it. In the experimental blast furnace at the Bureau's Minneapolis station it has been possible to produce a pig iron containing from 20 to 30 per cent manganese and to produce from this pig, in the steel furnace, a 60 per cent manganese slag from which it is hoped to make ferromanganese.

J. W. Furness, of the technical staff of the Bureau of Mines, estimated, at the request of the committee, that there are 35,000,000 tons of manganiferous and ferrous manganese ores in the United States. No effort ever has been made to estimate the extent of the reserves of low-grade carbonates and silicates, but it is known that they may be measured in hundreds of thousands of tons. Among other things Mr. Furness said:

"There is greater activity on the Cuyuna range today than at any time since 1911. In 1911 the use of manganiferous iron ore was practically negligible. The material discovered on the Cuyuna range could not be sold. Owing to the shortage of manganese throughout the world, manganiferous ore has been utilized more and more. The particular grade of ore from the Cuyuna range is sold on the iron-ore basis—that is, the value of Lake Superior ores. No credit is given for the manganese content—that is, aside from the manganese content plus iron—making the total metallic content for which the ore is paid for at Lake Superior prices. Those prices have been so low that the manganese content is cheaper in that particular grade of ore than in the high-grade manganese ores imported. For that reason it is cheaper for the steel companies, as long as they can buy material at that price, without credit to the manganese, in the sense of credit in comparison with foreign ores, to utilize that material. They use an excess of this low-grade material with manganese to accomplish a purpose that might be accomplished otherwise."

Dr. O. P. Hood at that point interposed the explanation that "we have this large quantity of manganese in the country and it is a valuable asset. At the present time it has to be sold at the Cuyuna range at the price of iron ore, which is very much below its real value. In the process of putting that through the blast furnace, I think only about 3 per cent of the manganese is used. Therefore, for the 3 per cent usefully employed they are willing to waste the balance because they can buy it at the low price of iron ore."

The proposed work is more in the interest of the producer of the ore who should sell his product for the manganese price instead of the iron price.

In discussing the $70,000 item for the continuance of oil-shale investigations, Mr. Turner was asked to put a limit on the continuance of the work. To that he replied:

"Our technicians in the Bureau feel that when started in an unknown field, for an unknown destination, going where no one else ever went before, there is no use in promising that you will have definite results by a definite date. It cannot be done. If the work is stopped June 30, then a year and a half will have been spent in erecting the plant, building roads and trails, putting in a tramway, opening a mine in a steep cliff and a mountain side, and only a scant six months will have been spent in operation. One quarter of the whole time covered by the original program will have been devoted to test runs and three-quarters of the time to construction. The construction is now finished. This program contemplates a year's run at full speed."

## Joplin Zinc Concentrate Costs $45 per Ton

It cost $45.87 per ton, on the average, to produce zinc concentrates in the Joplin-Miami district in December, according to a recent report of the Tri-State Zinc and Lead Ore Producers' Association. This compares with a cost for November of $45.26 and for October of $45.33. The following figures show comparative November-December costs:

| Operating Expense | 1926 Nov. | 1926 Dec. |
|---|---|---|
| Labor | $15.56 | $15.57 |
| Supplies and repairs | 5.16 | 5.09 |
| Liability insurance | .95 | .91 |
| Explosives | 2.58 | 2.38 |
| Exploration and development | 1.58 | 1.95 |
| Power, all classes | 2.75 | 2.84 |
| Fire and tornado insurance | .30 | .27 |
| Management and office salaries | 1.48 | 1.55 |
| Taxes, excluding federal income | .26 | .36 |
| Miscellaneous | .97 | 1.47 |
| Total operating expense | $31.59 | $32.40 |
| Depletion | 3.60 | 3.63 |
| Depreciation | 3.01 | 3.04 |
| Royalty | 7.06 | 6.80 |
| Total production cost per ton | $45.26 | $45.87 |

## Rich Gold Discovery at 85 Mine

High-grade gold-bearing ore has been discovered on the 15th level of the Eighty-five mine of the Calumet & Arizona Mining Co., Lordsburg, N. M. The ore occurs in connection with the regular copper vein, and silver values are also said to be important.

The Eighty-five mine was purchased several years ago for the silica content of the ore, this being designed for the company's smelter operations at Douglas, Ariz., there being a shortage of silica in that district. The mine is developing steadily and is said to be producing ore of profitable grade, in addition to its value as a silica flux.

## Western Apex Strikes Ore on 850 Level

The Western Apex Gold Mining Co., in the Oatman district of Arizona, which has been carrying on an extensive development campaign under the direction of George Long, has encountered ore on the 850 level from the No. 3 shaft of the United Eastern company. This drift had penetrated a distance of approximately 450 ft. before it entered the orebody discovered earlier on the 700 level above. The orebody has a length of approximately 1,250 ft. A big pump has been installed on the 850 to handle all the water developed in that section.

## New Phelps Dodge Shaft Progressing Satisfactorily

Sinking in the new three-compartment shaft of the Phelps Dodge Corporation in the Warren district in Arizona has progressed to a depth of 178 ft., under the direction of the E. J. Longyear Co., Minneapolis. The contractors are working three shifts daily and are averaging six feet every twenty-four hours. They are drilling, blasting, and timbering the shaft as they proceed each day. Twenty-five men comprise the crew.

# London Letter

By W. A. Doman

*Special Correspondent*

## East Geduld Mines and Indian Copper Corporation Launched

**London, Feb. 15**—Two mining companies make their appearance this week, one a gold-mining company on the Rand, the East Geduld Mines, and the other the Indian Copper Corporation. The former has a capital of £350,000 in £1 shares, and the latter is raising a similar amount in 7½ per cent debentures, issued at 98. East Geduld has been expected with great interest for some time in view of the circumstances of its formation. The public has been attracted to this part of the Rand by the excellent developments in the Sub-Nigel mine, though this particular property is to the southeast. East Geduld is the last lease area that can be obtained from the Union Government, and the terms are exceptionally favorable. The company is to carry on prospecting operations for five years, or until its initial capital is exhausted, should this occur earlier. Should these prospecting operations, in the company's opinion, warrant it, the program then contemplated is to sink a vertical shaft and to erect a reduction plant of a capacity of about 600,000 tons per annum, capable of being increased to about 840,000 tons per annum should the sinking of a second shaft be later decided upon. On the other hand, should the prospecting operations give the company reasonable grounds for believing that this program is not justified, then, if the Governor General is not prepared to agree to such modification of the lease as would enable some restricted program to be carried out, the company is to be entitled, without vertical shaft sinking, to extract and treat the payable ore from an area of about 947 claims bounded on the west by the property of the Geduld Proprietary Mines and on the east by a line 3,800 ft. from the common boundary and parallel thereto; the remainder of the area will then be excluded from the lease.

The Indian Copper Corporation—to which I have referred on previous occasions—has properties in the Singbhum copper field in the Chota Nagpur district of the Province of Behar and Orissa, India. Its rights cover a total area of thirty-four square miles. E. T. McCarthy estimates the ore reserves at 545,000 tons, of which upward of 453,000 tons average in value 4.16 per cent of copper, the remainder averaging about 2.41 per cent. The £350,000 of debentures have been purchased by a trust company at 96½, for a commission of 6¼ per cent and an option at 2s. 6d. per 2s. share on 2,293,296 shares. Treating 100,000 short tons of ore per annum, and with copper at £75 per ton in India, E. T. McCarthy estimates the annual profit at £97,508. Taking into consideration previous capital expenditure, the cost of developing the tonnage is very heavy; original shareholders have gone dividendless.

According to news from Edinburgh, what seems to be a valuable seam of tin has been discovered at Largs, in Ayrshire. A sample of rock has been analyzed and contains a percentage of tin "almost three times that found in several workings in use." The only doubt is as to whether the assay value persists in depth and is consistent throughout the property.

## Indian Gold Mining

*(By Our Indian Correspondent)*

Five mining companies carried on gold mining in India during 1925. All of them worked successfully and paid dividends on a paid-up capital of £1,660,000. The total output of gold during the year was 394,512 oz., and the quantity of byproduct silver was 24,850 oz. The total value of both the precious metals produced was £1,686,000. This was less than the production of the previous year by £150,000. The total amount paid in dividends by all the companies was £309,000, or 18½ per cent, and the government received a royalty of £91,000, as against £95,000 in the previous year. The estimated ore reserves on the gold fields at the end of the year amount to 1,500,000 tons.

The number of persons employed in the gold-mining industry was 22,000, out of whom mining alone required 19,300, comprising 330 Europeans and 365 Anglo-Indians, the rest being Indians. About 9,900 were employed underground. The relationship between employers and employees remained satisfactory.

Rock bursts seem to be fairly common in this industry. There were, it is stated, 9,600 rock bursts during 1925. The total number of injuries reported were 220, of which 47 were fatal and 160 were serious.

## Quebec to Aid Mining

Premier Taschereau, of Quebec, recently stated that "The government of Quebec is keenly alive to the great possibilities of its mineral areas and will give every legitimate aid to companies engaged in development work. It is also giving the question of stock flotations keen consideration, with the view of preventing stock-selling abuses, which result in incalculable harm in all mining camps. The problem is a difficult one, and it is necessary to proceed with utmost caution. Nevertheless, no stone will be left unturned by the administration to protect investors in Quebec mines so far as possible. The future of the province from the viewpoint of its mineral development is tremendous, and it is the government's intention to aid in making it a fruitful field for the investor."

## Wright-Hargreaves Plans 700-Ton Mill

The management of the Wright-Hargreaves, Kirkland Lake, Ont., has decided to increase the capacity of the mill to at least 700 tons. Its exact size will not be determined until after Edwin L. Miller, president, and Oliver Kavanagh, a director, have visited the property and consulted with Mr. Miller, the mine manager.

# Johannesburg Letter

By John Watson

*Special Correspondent*

## Rand Gold Production 9,962,852 Fine Ounces in 1926—Less Native Labor

**Johannesburg Jan. 25**—The following results of crushings for the month of December, 1926, from fifteen leading Rand gold mines have recently been published. The mines are arranged in order of profits earned:

| | Tons Crushed | Value or Revenue £ | Costs per Ton s. | d. | Estimated Profit £ |
|---|---|---|---|---|---|
| Government Areas | 200,000 | 388,313 | 16 | 0.4 | 230,272 |
| New Modder | 129,000 | 299,232 | 18 | 11.0 | 177,208 |
| Crown Mines | 202,000 | 286,552 | 20 | 3.9 | 81,283 |
| Modder Deep | 44,200 | 99,604 | 15 | 3.0 | 65,883 |
| Springs | 69,200 | 129,641 | 19 | 1.4 | 63,483 |
| Brakpan | 86,500 | 138,412 | 18 | 5.5 | 58,568 |
| New State Areas | 72,000 | 132,214 | 21 | 8.9 | 54,276 |
| Van Ryn Deep | 67,400 | 106,505 | 17 | 1.0 | 50,213 |
| Modder B | 63,500 | 110,733 | 19 | 2.1 | 49,837 |
| Geduld | 80,000 | 117,704 | 17 | 2.0 | 48,951 |
| West Springs | 49,400 | 78,545 | 18 | 7.8 | 32,489 |
| Randfontein | 193,000 | 207,152 | 18 | 6.9 | 30,253 |
| Sub-Nigel | 14,800 | ..... | 41 | 4.3 | 25,181 |
| Robinson Deep | 70,000 | ..... | 19 | 11.6 | 24,354 |
| City Deep | 96,500 | 129,731 | 22 | 4.0 | 21,977 |

The output of gold for the month of December, 1926, was declared by the Transvaal Chamber of Mines on Jan. 10 as 836,157 oz., having a value of £3,551,769. As compared with November, these figures show a decrease of 4,119 oz., equal in value to £17,497 Native labor returns show that only 175,492 "boys" were working on the Witwatersrand gold mines on Dec. 31, as compared with 177,544 on Nov. 30. The December figures complete the year 1926, which shows the record output of 9,962,852 oz. of gold, having a value of £41,773,159. The aggregate gold production for the Transvaal since the start of gold winning amounts to 208,563,240 oz., out of which the Witwatersrand has produced 200,918,460 oz.

The annual meeting of the Potgietersrust Platinums, Ltd., was held in Johannesburg on Dec. 28, when the chairman, J. H. Crosby, said, "Although rapid strides have been made in the entirely new industry of extracting platinum from its ores, a large amount of research and experimental work remains to be done before maximum extraction is reached. The company's areas should be able to supply all the platinum and palladium that the world will be able to absorb, at a price which will give a satisfactory margin of profit to the producers."

## Siscoe Nears Production

It is understood that negotiations are under way for the purchase of a mill of from 50 to 100 tons' daily capacity for Siscoe Gold Mines, Ltd., Siscoe Island, via Amos, Quebec. According to S. E. Siscoe, vice-president of the company, it is hoped to have the mine go into production by the latter part of May. The Siscoe gold mines are situated at Lac de Montigny, in Dubuisson Township, 32 miles southwest of Amos and approximately 50 miles east of Rouyn.

# Melbourne Letter

**By Peter G. Tait**

*Special Correspondent*

## Consolidated Goldfields Invests in Wiluna—Gold Discovery in New Guinea

**Melbourne, Jan. 26** — The Consolidated Goldfields of South Africa, Ltd., has made its first investment in Australian mining by acquiring an interest in the Wiluna Gold Corporation of Western Australia. This property was acquired by London investors in the Kalgoorlie mines and is now being developed. A small pilot mill is being erected to demonstrate that the ore can be treated successfully, and provided the results are satisfactory the corporation has the right to take up a larger interest in the venture. The government has undertaken to build a railway to the field provided the company raises the necessary capital for development and erection of mining and treatment plant.

In addition to the installation of an electrolytic refining plant at Queenstown at a cost of £75,000, the directors of the Mount Lyell M. & R. Co. have authorized the general manager, R. M. Murray, to proceed with the driving of a tunnel 6,700 ft. in length at a cost, including equipment, of about £60,000. This tunnel will be driven from a point near the reduction works at Queenstown to the 1,100 level of the North Mount Lyell mine. It will not only facilitate the prospecting of the company's leases, but will also reduce the cost of pumping, winding, and transporting ore. It is estimated that the expenditure will be met by savings in working costs within four years from the date of completion.

### Gold in New Guinea

The administrator of New Guinea, General E. Wisdom, who arrived in Australia recently, in speaking of the recent gold discoveries in New Guinea, said that they were phenomenal but not of very great extent. Prospectors discovered gold on some of the tributaries of the Bulolo River three years ago. Those deposits were washed, but were not found to be very rich. The prospectors then went on into the jungle and struck Edie Creek at its confluence with the Bulolo. They worked up the creek, but without payable results. They then climbed to the higher levels of the creek, a rise of about 4,000 ft., and there found the rich gold which has been the subject of such sensational reports. There was very little gold on the Bulolo itself, but the rich find at Edie Creek had drawn attention to the need of other methods of working than by box sluicing and dish. Considerable areas had been taken up on the Bulolo, where values were estimated to average about 17d. per cubic yard. Such country was only suitable for working by dredge or by heavy hydraulic machinery, and lease holders intended to employ these methods. An airplane service is being established by the Guinea Gold Co. This will enable the journey, which now takes six days of arduous climbing, to be accomplished in about half an hour.

Richard Hamilton, who has been general manager of the Great Boulder Proprietary Gold Mining Co. since 1896, resigned at the end of December. At the request of the directors he has accepted the position of local director and local attorney for the Great Boulder company. Mr. Hamilton, who was formerly a manager at Bendigo, has a unique record in Australian mining, having controlled the Great Boulder practically from the beginning of operations at that property. During his term gold of the approximate value of £14,000,000 has been produced, and £6,000,000 has been paid in dividends. He has occupied the presidency of the Kalgoorlie Chamber of Mines for a number of years. J. Warwick, the Boulder mine manager, has been appointed acting general manager of the Great Boulder.

## Mexican Corporation Produces 2,800 Tons Daily at Fresnillo

The Mexican Corporation, Fresnillo, Mexico, is treating 2,800 tons of ore a day and is preparing to increase its output. This property has been constantly worked since 1833. The ore is low-grade silver, containing some zinc, and is mined by open-cut methods on the mountain side. S. N. Cook is general manager of the company.

## Tinaja Mine Plans Mill

The Tinaja, a high-grade property, is being developed near Ruidosa, Tex., by Monroe Slack and associates. The ore, which averages about 42 per cent lead and 10 oz. of silver to the ton, is hauled in trucks to Marfa, Tex., the railroad shipping point. Plans for the construction of a concentrating plant are now being considered.

# Societies, Addresses, and Reports

## Oregon Section A.I.M.E. Elects Officers

At a meeting of the members of the Oregon Section of the American Institute of Mining and Metallurgical Engineers held at the Chamber of Commerce, Portland, Ore., Feb. 12, the following officers were elected for the ensuing year: Chairman, C. E. Newton, Dean of the School of Mines, Oregon Agriculture College, Corvallis, Ore.; secretary-treasurer, J. H. Batcheller, Corvallis, Ore.; executive committee, C. D. Emmons, Henry M. Parks, and F. W. Watson.

## Empire Mining Congress Meets in August

The Empire Mining and Metallurgical Congress (in Canada) will hold its second (triennial) meeting in Montreal, Canada, on Monday, Aug. 22, 1927. In connection with this meeting the congress plans an extended excursion from Montreal to Prince Rupert and return. The total cost of the excursion will be about $500. Full details may be obtained from George C. Mackenzie, general secretary, Drummond Building, Montreal, Canada.

## Engineering Foundation Elects Officers

Re-election for the third time of Lewis Buckley Stillwell as chairman of the Engineering Foundation, research agency of the national societies of civil, mining, mechanical, and electrical engineers, was announced following the organization's annual meeting Feb. 17. Arthur D. Little, Cambridge, Mass., was elected a vice-chairman and George A. Orrok was re-elected as vice-chairman. Other officers elected were: Director and secretary, Alfred D. Flinn; treasurer, Jacob S. Langthorn; assistant treasurer, Harry A. Lardner.

Progress was reported in several research undertakings now under way, notably in the construction of an arch dam at Stevenson Creek, near Fresno, Calif. This enterprise involves the building of an experimental structure to a height of about 100 ft. and its gradual testing to destruction in the interest of science at a cost of $100,000.

## American Zinc Institute Elects Officers

A. T. St. Clair, of Baxter Springs, Kan., purchasing agent for the Federal Mining & Smelting Co. in the Joplin-Miami field, was elected president of the Tri-State branch of the American Zinc Institute, at a recent meeting of directors, held in Picher, Okla. He succeeds W. T. Landrum, manager of the Cortez-King Brand Mines Corporation, who was elected first vice-president. D. C. McKee, representative of the Empire District Elect Co., was named second vice-president, and Richard Jenkins was re-elected secretary and treasurer.

## Idaho Miner Honored

Frederick Burbidge, manager of the Federal Mining & Smelting Co., was unanimously elected president of the Idaho Mining Association at its recent convention in Boise. Mr. Burbidge has been actively engaged in mining in northern Idaho for thirty years.

Other officers elected at the convention were J. B. Eldridge, of Boise, vice-president; Jerome Day, of Moscow; I. E. Rockwell, of Bellevue; F. E. Johnesse, S. T. Davis, and Robert N. Bell, of Boise, and C. E. Nighman, of Canada, members of the executive committee; and Ravenal Macbeth, secretary, a position he has held for fourteen years.

The convention adopted a resolution against "bluesky" legislation which is now pending before the Idaho Legislature, and also protested against any federal legislation limiting mining rights in the national forests.

# People You Should Know About

**E. H. Laws** has joined the staff of the Nichols Copper Co. as metallurgist.

**Horace Graham** has returned to Bolivia after a vacation in New York.

**William Wraith,** vice-president of the Anaconda Copper Mining Co., has returned from Chile.

**E. C. Clapp** has resigned as assistant general manager of the Minas de Matahambre and is in Bourbonnais, Ill.

**Ex-Senator Frank J. Cannon,** of Denver, visited Salt Lake City recently on business in relation to a revival of operations at Aspen, Colo.

**Clinton H. Crane** and **Arthur R. Mitchell,** of the St. Joseph Lead Co., are making an inspection of the company's properties in Missouri.

**Frederick Burbidge,** general manager for the Federal Mining & Smelting Co., has returned to Wallace, Idaho, after a brief visit to New York.

**Gerald H. Hutton,** with the H. P. Whitney interests in charge of gold-dredging operations in California, resigned and left late in January for New Zealand.

**C. W. Newton,** vice-president of the Seneca Copper Corporation, has returned to Wallace, Idaho, after a visit to the property in the Michigan copper district.

**C. C. Felton,** of Boston, has arrived in the Michigan copper district to engage in some special work for Calumet & Hecla Consolidated at its Hubbell smelter.

**Thomas D. Harris** is now in charge of the Lewiston Dredging Co. of California at Lewiston, Calif. Mr. Harris was formerly manager of the Marysville Dredging Co.

**Bert L. Cripps,** assistant secretary-treasurer of the Chief Consolidated Mining Co., has returned to Salt Lake City after a short stay at the company's Eureka, Utah, headquarters.

**J. K. Fletcher,** who is in charge of the field work for the Noranda, of Rouyn, Quebec, has gone to Savant Lake to make an inspection of property under option to the Noranda.

**C. F. Jackson,** mining engineer associated with the Standard Oil Co. of New Jersey, left New York recently for South America, where he will spend three months on professional business.

**C. T. Van Winkle,** Salt Lake City consulting engineer and secretary of the Utah section of the American Institute of Mining and Metallurgical Engineers, attended the annual New York meeting of the society.

**John Gates Williams,** vice-president of the Mississippi Valley Trust Co., and prominent in financial circles in St. Louis, has been elected to the board of directors of the Golden Rod Mining & Smelting Co.

**Sir Francis Drummond Chaplin** has become a director of the Anglo-American Corporation of South Africa, Ltd., He is already a director of the British South Africa Co., Ltd., and of the Robinson Deep, Ltd.

**Robert E. Tally,** managing director of the United Verde Copper Co. at Jerome, Ariz., has been appointed chancellor and president of the board of regents of the University of Arizona, by Governor Hunt of that state.

**F. W. Beyers,** Minister of Mines for the Union of South Africa, and his private secretary are remaining in Capetown until June next, so the headquarters of the Department of Mines and Industries will be located at Capetown until June.

*M. L. Campbell*

**M. L. Campbell,** mining engineer, of Oruro, Bolivia, has just returned to that city after making an examination of some tin mines in the Autequera district of the Department of Oruro. He will soon undertake an examination of a lead-silver property in the Salinas de Garcia Mendoza district, in the same department.

**W. C. Mansfield,** of the Geologic Branch of the U. S. Geological Survey, left Washington on Feb. 6 for field work in the Everglades region of Florida in co-operation with the Florida State Geological Survey in preparation of a geologic map of Florida.

**J. Raymond Coulter,** who for the last few years has been connected with the chemical branch of the electrolytic zinc plant of the Anaconda Copper Mining Co. at Great Falls, will take over similar duties with the company at its Giesches Erben plant in Poland.

**Robert de la Bouglise,** mining engineer of the Compagnie des Mines et Minerais, of France, who has been making an inspection of mining properties owned by his company in the western part of the United States, recently visited Butte, where he inspected claims which his company owns in the Walkerville district and in the southwest portion of the camp.

**Paul Billingsley** has resigned as chief geologist for the International Smelting Co. to open up an office in Salt Lake City as consulting geologist. In addition to private work, Mr. Billingsley will be retained as consulting geologist to the Anaconda Copper Mining Co., the International Smelting Co., and several companies operating in the East Tintic district.

**H. A. Titcomb** and **R. M. Geppert,** American engineers, arrived in Brisbane, Australia, early in January, on their way to Mount Isa, in the Queensland Cloncurry district, where they are to report on the silver-lead mines of the Mount Isa Mines, Ltd., for the Anglo-American Corporation of South Africa, which holds an option to take 550,000 £1 shares in the former company.

**Dr. A. P. Coleman,** professor emeritus and former dean of the faculty of arts of the University of Toronto, who has attained his seventy-fifth birthday, was tendered a banquet at Victoria, Toronto, on the evening of Feb. 25. He was presented with a portrait of himself by **Dr. W. A. Parks,** professor of geology, which will be hung in the Mining Building of the university. Speeches in recognition of the work of Dr. Coleman during the last forty years were made by **Prof. George F. Kay,** of Iowa University, **Chancellor Bowles** of Victoria College, **T. W. Gibson,** Deputy Minister of Mines, and **Dr. W. A. Parks, Sir Robert Falconer,** president of the university, presided.

## Obituary

**John P. Hamilton,** for some years connected with the Allis-Chalmers Manufacturing Co., died on Jan. 24. He was fifty-one years old.

**J. Robert Wylie,** president of the Prosperity Mining Co., near San Andreas, Calif., met with accidental death Feb. 18, 1927, from inhaling cyanide fumes which were formed when he was preparing a cyanide solution for use in the mill at the property.

**W. B. Westerdahl,** superintendent of the Combined Metals Reduction Co. mines at Pioche, Nev., was instantly killed on Feb. 16 when while driving on the Salt Lake-Magna highway he touched a live wire. Mr. Westerdahl, who was born in Sweden on March 14, 1881, is survived by his widow and a young son.

**Arthur Edward Feust,** consulting mining engineer and secretary of the Livingston Mines Co., died on Feb. 24, at the age of forty-seven. Mr. Feust was born in New York and was a graduate of the Columbia School of Mines. He served in the World War as a regional director of the Industrial Board of Joint Survey. Mr. Feust was a member of the A.I.M.E. and of several fraternal societies.

**Moylan C. Fox,** aged seventy-nine, director of the Silver King Coalition Mines Co., vice-president of the Park-Utah Consolidated Mines Co., director of the Continental National Bank, and former president of the Eureka Hill Mining Co., operating one of the richest and the first important producers in the Tintic district of Utah, died on Feb. 13 at Salt Lake City. Mr. Fox, who came to Utah as a young man, became identified with some of the state's most productive properties at the beginning of their activities. He was born at Columbia, S. C., on Aug. 5, 1847. In 1875, he came to Utah. He married Emily C. Lawrence, daughter of Captain Joab Lawrence, a pioneer mining man. Surviving Mr. Fox are a son, Lawrence Fox; a daughter, Mrs. Edson Adams, and his widow.

# Recent Technical Publications

Reviews, Abstracts, and References

## Meager Coal and Iron Supplies in China

**A Geographical Study of Coal and Iron in China.** The University Press of Liverpool, Ltd. Hodder and Stoughton, Ltd., London. Price, 5 shillings.

This little book of some eighty pages was prepared by Mr. Smith, a tutor in the department of geography of the University of Liverpool, with an introductory note by Professor P. Roxby. It is a most convenient and up-to-date summary of existing knowledge and an interesting illustration of the modern interpretation of economic life in terms of the geology of the country. So far as noted, the facts are accurately stated where the published material was available. The author has wisely relied upon Tegengren's report for his data as to iron ore. No corresponding summary of the coal fields is available, N. F. Drake's estimates having been preliminary and now being far out of date, and W. H. Wong's figures being as yet supported by no material details.

Mr. Smith has been more successful as a compiler than as an interpreter. His conclusions are by no means always consistent, nor are they always in accord with the facts. Having on page 34 recognized that the Shansi iron ores are worthless from the point of view of modern industry, he on page 65 recurs to the possibility of working them in connection with the coking coal at Liuhokow; and on page 67 comes back to the conclusion that "the iron ores of Shansi are unsuited to modern large-scale blast furnace practice." Similarly, having accepted Tegengren's estimates of iron-ore reserves and conclusions as to their meagerness (page 40), and being familiar with the cost of steel making in China, he nevertheless reaches the conclusion (page 53) that "the ultimate future of the iron and steel industry in China is not open to question," which, as a matter of fact, is true only if taken in a sense contrary to that intended. The present high cost of steel manufacture in China is not merely a matter of lack of experience. High ash content in coke, the low grade of the bulk of the ores, the long distances between ore, coal, and market, are all important and discouraging. Over all is the fundamental fact, as recognized by Tegengren and others, that the known amounts of ore of furnace grade are utterly inadequate to any large production. Possessing the coal fields that it does, and with its large, industrious, and able population, China will in time become an important member of the industrial countries of the world, but its industries will not rest on large production of iron and steel from domestic ores.

H. FOSTER BAIN.

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**Mineral Statistics**—The Imperial Institute has recently issued a "Statistical Summary" of production, imports, and exports for various minerals and metals, covering the years 1923 to 1925. Data for all countries are given in this 346-page volume, which may be obtained from The British Library of Information, 44 Whitehall St., New York City, or from H. M. Stationery Office, London, W. C. 2, England, for 8s. 4d.

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**Engineering Metallurgy.** By Bradley Stoughton and Allison Butts. Mcgraw-Hill Book Co., New York. Price $4.

This is a textbook for students in the branches of engineering that are concerned with the uses of metals, methods for obtaining and refining metals being given only incidental treatment. The reader is given an understanding of the relations of structures and properties, heat-treatment, effects of impurities in metals, and the effects on metals of differences in production processes. The last five chapters have to do with corrosion; fuels and combustion; metallurgical slags, fluxes and refractories; pyrometry; and heat losses and heat transfer in industrial furnaces. The book therefore covers a wide field in its 400-odd pages, and makes greater appeal to the student and general reader than to the specialist. References to the important literature on the various subjects are appended to each chapter, and numerous photographs are reproduced, though with none too great success in some instances.

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**Applied X-Rays.** By George L. Clark. McGraw-Hill Book Co., New York. Price $4.

Not so long ago the X-ray was, for most of us, a laboratory curiosity; then we began to know it as an aid in medical and surgical science, to find out which teeth should be pulled, which bone was broken, or between which ribs the bullet lodged. More recently, we have heard of the use of the X-ray in the study of crystalline structures, and for the determination of space lattices. Now comes Professor Clark, of "Boston Tech," with a book to explain all about what has been going on to us and to show us how the X-ray can be made a valuable tool in industry. The microscope is only beginning to be recognized as an invaluable aid to the investigator in the realms of ore dressing, concentration, smelting, leaching, and refining; now, it seems, one should also have X-ray equipment in order to be up to date.

The first section of this volume is devoted to "the fundamentals of X-ray science"; the second to "the direct effect and applications of X-radiation"; and the third to "the X-ray analysis of the ultimate structures of materials." The book appears sufficiently technical to be of use to the X-ray operator and yet is not so abstruse but that any trained engineer can obtain from it some idea of the usefulness of this new tool in his particular work.

**Mint Report**—The annual report of the Director of the Mint for 1926 is now available on request from the Treasury Department, Washington, D. C. The report gives the usual amount of informative data regarding the currency systems and gold and silver stocks of the various countries of the world, as well as more detailed data for the United States.

**Geological Survey Report**—The annual report of the Director of the U. S. Geological Survey, Washington, D. C., pp. 96, was recently issued, and may be obtained on request to the Director.

**Directory of Organizations**—The U. S. Department of Commerce, Washington, D. C., recently issued a list of the "Commercial and Industrial Organizations of the United States," pp. 191, obtainable for 60c. from the Superintendent of Documents, Washington, D. C. Names, addresses, purposes, number of members, and dates of annual meetings of about 9,000 organizations are given. Governmental, educational, professional, civic, agricultural, and religious organizations are excluded. The bulletin is known as Domestic Commerce Series, No. 5.

**Mining at Chuquicamata**—*The Mining Congress Journal* for December (Washington, D. C.; price 30c.) contained an 8-page article by William H. Goodrich on "Mining Operations at Chuquicamata, Chile." Mine development, churn drilling, explosives handling and blasting, underground work, shovel operations, transportation, water, and power equipment are discussed briefly, with tabular data and photographs.

**Direct Iron Reduction**—"Making Iron Without Coke at Minnesota Mines" is described by E. W. Davis in articles in *Iron Trade Review* of Jan. 13 and 20 (Cleveland, Ohio; 25c. each). Mr. Davis tells what has been accomplished and describes the process considered most feasible in the work at the Minnesota School of Mines experiment station. A minimum of coal is used for direct reduction, the product containing only a small fraction of a per cent of silicon, about 2 per cent of carbon, and sulphur and phosphorus each below 0.04 per cent.

**Mexican Mining Statistics**—The Anuario de Estadistica Minera, for the year 1924, has recently been issued by the Secretario de Industria, Comercio y Trabajo, Mexico, D. F. (pp. 292). Very complete statistics regarding production, price, employment, and similar matters are covered in this book, the data covering several years previous to 1924 as well.

**Asbestos** — The Bureau of Foreign and Domestic Commerce, Washington, D. C., recently published Trade Information Bulletin No. 442, entitled: "Asbestos: Sources and Trade," pp. 22, price 10c. The industry is described in each of the important foreign producing countries, with the names and addresses of many of the producers.

**Montana Geology**—"The Geology of the Ingomar Anticline, Treasure and Rosebud Counties, Montana." is discussed by K. C. Heald in U. S. Geological Survey Bulletin 786-A, pp. 37, obtainable on request to the Survey, Washington, D. C.

# New Machinery and Inventions

*A 300-kva., 33,000-volt outdoor transformer station equipped with an automatic reclosing feeder*

## Outdoor Substations Supply Required Reliability

During the past few months there has been a steady growth in the demand for outdoor station equipments, such as that shown in the accompanying illustration, and for disconnecting switches for potentials of 154 to 220 kv. This gives a clear indication that the application of these voltages to the transmission systems of the country is steadily increasing.

The demand for reliable service from transmission and distribution lines is just as pressing in the systems of mining companies as it is in those of the public utilities. This is particularly true among those companies which maintain their own central power-generating stations, and also those companies which take purchased power at a central point.

Further progress has been made in the standardization of outdoor stations, and a new line of standard equipment has been designed to take care of stub-end transformer step-down stations of voltages from 37 kv. downward, and of transformer bank capacities of 3,000 kva. and below. Steel structures for such stations are produced in two sizes, which with slight modification can be arranged for thirty-one different combinations of switch-gear.

According to the General Electric Co., Schenectady, N. Y., many new types of disconnecting switches are built, among them a horn gap type for voltages of 15 to 73 kv. and 400- and 600-amp. rating.

A switch of the tilting insulator type, with a short, stubby blade which closes with a chopping action into a floating contact made up of two half-cylinder copper blocks acting against double helical springs, is provided. These springs press the cylinders against the blade, establishing a line-pressure contact which has proven to be more satisfactory than surface contact. The chopping action of the blade and the free movement of the floating contacts are effective sleet-removing features which assure satisfactory operation of this type of switch under the sleet conditions usually encountered. The use of an insulated handle for the operation of the switch affords protection to the operator.

In the line of high-voltage disconnecting switches, ratings of 132 to 220 kv. and both 600- and 800-amp. capacity were produced with manual or motor-operating mechanisms. This type of switch is designed to isolate six poles of an oil circuit breaker by means of one operating mechanism, which may be manually or motor actuated.

A new type of fuse has been developed for voltages of 73 kv. and below, and ampere ratings of 100 and below, which minimizes the faulty operation of fuses due to incorrect fusing by the operator. The fuse holder is made up in such a manner that the blowing of the fuse makes it necessary to discard the fuse holder, so that the operator has to install a new holder and fuse entire.

To meet this condition without involving considerable expense, a fuse holder is available in the form of an inexpensive impregnated fiber tube in which a fuse element of short length is suspended and connected to a flexible, copper pig-tail, which in turn is held taut by a bronze spring. The melting of the fuse wire releases the tension on the copper pig-tail and also allows the compressed spring to be released, forcing the copper pig-tail out of the fiber tube, and thus allowing a free path for the gas to be discharged. This type of fuse has exceptionally high interrupting capacity and a wide application on high tension systems.

A new line of resistors for 15-, 25-, and 37-kv. circuits permits fusing the potential transformer circuits on systems having short circuit kva. in excess of the interrupting capacity of the fuses used.

## Simple Induction Motor for General Application

A new type of induction motor which, with its control, is even simpler to operate than the ordinary squirrel-cage motor and compensator, is announced by the General Electric Co. A complete line of these motors, bearing the type designation FT and ranging in ratings from 7½ to 50 hp., has been placed on the market. Though large numbers of high-reactance motors of somewhat similar characteristics have been built and applied during the period of development, this is the first coordination of a complete line for general-purpose application.

The FT motor is in general suitable for application wherever the ordinary squirrel-cage induction motor with a compensator has been used. It is designed to start on full voltage, giving slightly higher starting torque but approximately the same starting current as the ordinary squirrel-cage induction motor started with the compensator connected to the 80 per cent tap.

In appearance the new motors are the same as the ordinary squirrel-cage induction motor. Rotors are of the cast-aluminum type, with bars so shaped and located in the punchings as to give a high reactance effect at starting. Starting current is within the N.E.L.A. limitations up to and including the 30-hp. size.

Control apparatus required is simple. An ordinary line switch of proper capacity can be used, but, to obtain proper overload and undervoltage protection, the motors are recommended by the manufacturer for use with magnetic-starting switches using push-button control. Where necessary, on the larger sizes, a compensator or resistor starter may be used, as in the case of the ordinary squirrel-cage induction motor.

## New Refractory of Magnesite Introduced

A new improved magnesite refractory, to be known as Marksite, has been announced by the General Refractories Co., of Philadelphia. Marksite brick, which are covered by patent, have been used in the plant of a prominent metal smelting and refining company for the last two years. In large copper-refinery furnaces these brick, it is claimed, have outlasted from three to four times the best magnesite brick heretofore procurable. Likewise in converters, they have given two to three times the service of the highest-grade magnesite brick previously used.

Marksite employ a special bond, which reduces porosity, cuts down absorption of oxide and slags, and produces a brick that is highly resistant to spalling under furnace conditions. This special bond also results in a brick of greater mechanical strength and one that is more resistant to erosion induced by poling and blowing. Owing to this and other patent features, the new brick is expected to give materially longer service where magnesite brick are now used in the smelting and refining of copper, lead, and nickel.

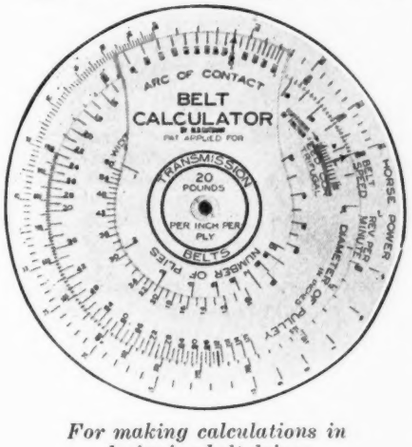
## An Aid in Designing Belt Drives

To facilitate the work of designing a belt drive, a device for making the necessary calculations has been developed by M. B. Cutshaw, of 2759 Gilpin St., Denver, Colo. This calculator is composed of three members—namely, two disks and a rider, all mounted so that they revolve about a common center. It is shown in the accompanying illustration. The calculator is graduated for belt-transmission problems with scales reading direct as follows:

Horsepower from 3 to 300
Belt speeds from 100 to 6,000 r.p.m.
Revolutions per minute from 100 to 6,000
Pulley diameters from 1½ in. to 120 in.
Arc of contact from 90 to 270 deg.
Width of belt from 1 in. to 60 in.
Number of plies from 1 to 10.
Coefficient of friction from .25 to .35

It is stated by Mr. Cutshaw that though this range has been found to cover most of the problems generally found in practice, it may be extended indefinitely by the proper location of the decimal point when interpreting results.

The calculator is designed for use




*For making calculations in designing belt drives*

with the best grades of rubber belt. If cheaper grades are to be used, it is stated, the load upon the belt should be decreased in proportion to the strength of the belt. The calculator can be used for leather belts by solving for the equivalent rubber belt as shown on the back of the calculator.

## Novel Ball Bearings

A new type of deep-groove ball bearing in standard sizes with both double and single row is announced by the McGill Metal Co., Valparaiso, Ind. These are to be marketed under the name of Schubert. One of these bearings is shown in the accompanying illustration. It is claimed that the dimensional tolerances of the new bearings have been reduced to approximately one-half of the standard S.A.E. tolerances and that particular attention has been given to the finish of the high-carbon, alloy-steel surfaces of the races and the balls. The bearings are of the deep-groove, non-filling, slot type, which, it is said, are capable of carrying both axial and thrust loads.

*Deep-groove ball bearing*

The retainer for the bearings is made of McGill metal, which is a modified aluminum bronze that, it is stated, may be die-cast within very small tolerances and has physical properties closely approximating mild steel. The manufacturer states that the decrease in weight of the retainer, which results from using this metal, is important, especially at high speed. It is stated also that the high inherent heat conductivity of the bronze tends to dissipate any heat developed.

## A Substitute for Platinum

An alloy metal suitable for use as a substitute for platinum has been placed on the market recently by the Palo Co., 153 W. 23d St., New York, N. Y. This metal, called "Palorium," is an alloy of gold with metals of the platinum group. It is a while alloy, in appearance almost identical with platinum. Hardness and tensile strength compare favorably with platinum, as does also the temperature coefficient. It may be sealed in glass and used effectively. When heated it retains its original stiffness and does not soften as platinum does, which is said to offer considerable advantage in plant and laboratory use. It is malleable, ductile and homogeneous, melting at 1,310 deg. C.

Tests conducted with this alloy heated by gas flame in crucibles of 16.0635 grams, in contact with reagents, duplicating actual working conditions, gave results in comparison with platinum as given below:

| Reagent | Time, Hours | Losses in Milligrams Platinum | Palorium |
|---|---|---|---|
| Conc. HCl .... | 3 | 0.5 | 5.3 |
| Ignition ..... | 2 | 0.5 | 0.9 |
| $Na_2CO_3$ fusion. | 5 | 0.1 | 2.6 |
| $NH_4OH$ ..... | 2 | 0.0 | 0.2* |
| $KHSO_4$ ..... | 3 | 2.2 | 26.7 |
| KOH 40 per cent | 2 | 0.2 | 0.4 |
| $K_2S$ ..... | 3 | 0.0 | 0.2 |
| Conc. $H_2SO_4$ .. | 2 | 13.0 | 0.7 |
| Dil. $HNO_3$ .... | 2 | 1.4 | 29.7 |
| Conc. $HNO_3$ .. | 3 | 0.1 | 16.9 |
| KOH fusion .. | 2 | 2,379.2‡ | 23.0 |

*Gain.
‡Crucible failed.

Since the time of tests varied from 2 to 5 hours and the crucible was filled to capacity each time, the alloy was subjected to harder usage than ordinarily encountered. Resistance to potassium hydroxide fusion and to concentrated sulphuric acid was superior to platinum, and in other cases the losses were sufficiently close to make it a possible substitute.

Further tests showed very small losses for periods under one hour. For instance, loss in weight after 40 minutes with conc. HCl was 0.9 milligrams and for one hour was 1.0 milligrams.

The metal may be used in electrolytic determinations, but only as a cathode. It is obtainable as cathodes, crucibles, dishes, sheet, wire, contact points and various other commercial forms. Its cost is approximately 45 per cent less than that of platinum.

## Block Lowers by Gravity

Development and final marketing of a gravity-lowering chain block is announced by Herbert Morris, Inc., Buffalo, N. Y. It is stated that steel plate and forgings are used throughout in the construction of this device. The worm has a double thread and is turned from a solid steel shaft which is then heat-treated, hardened and ground. Ball bearings are used to take the end thrust on the worm shaft. The load-chain wheel and worm wheel are made in one piece. An automatic brake on the worm shaft sustains the load whenever the hand chain is released. A centrifugal brake keeps the lowering speed within safe limits when lowering by gravity. Over-lowering is prevented by an automatic stop which applies the brake as the hook reaches its lowest point. This unit is rated at 1 ton, but, it is stated, this allows for a considerable margin of safety.

For hoisting, only a light pull on the hand chain is necessary. To lower by gravity, a pull on the gravity lowering handle releases the automatic brake. The hand chain does not move when lowering by gravity. However, the load may be lowered by pulling on the hand chain, as is necessary when adjusting a load or when lowering a very short distance.

*Automatic brake on this block holds the load*

**Arc Welding**—The American Society of Mechanical Engineers, 29 West 39th St., New York, has issued an official statement of the conditions governing the award of the Lincoln arc-welding prizes for 1927. Three prizes, of $10,000, $5,000, and $2,500 respectively, will be given for the best three papers disclosing advancement in the art of arc welding.

# Market and Financial News

## Consolidated M. & S. Netted $13,255,406 in 1926

### Canadian Pacific Group Owns 60 Per Cent of Shares—Large Allowances for Reserve Funds—Dividends $3,238,053

THE Consolidated Mining & Smelting Co. of Canada has issued the statement that, after setting aside $2,274,771 for additions to properties, it made a net operating profit of $8,615,735 during 1926, which compares with a net operating profit, after setting aside $3,560,793 for additions to properties, of $6,219,843 in 1925. Increased production and reduced costs, the company states, more than offset the drop in metal prices. Operations are progressing satisfactorily; there are no unsold stocks of metals.

The suggestion by some of the minority shareholders that, to allow of easier trading on the exchanges, the shares of the company, now quoted at between $240 and $250, should be divided, did not meet with the approval of the directors, who hold that the company is a producing, not a stock-jobbing, concern. An analysis of the shareholdings at the end of last year disclosed that, exclusive of what might be described as Canadian Pacific shares—that is, shares owned by the Canadian Pacific Railway Co. and associated interests—approximately 200,000 out of 507,012 outstanding shares are held by 2,000 people, or 100 shares per person.

The following extract from the company's annual report for 1925 will give an idea of the liberal allowances that are made in computing the company's net operating profit:

"After taking care of current development, depreciation of plant, depletion of property, paying interest on bank loans, and setting aside $200,000 as a pension fund for employees, and $234,679 as a fire insurance reserve, and providing $517,521.30 for bond interest, including exchange and premium on redemption, the net profits were $13,255,406.

"Your auditors have advised the setting up of a reserve of $3,560,793, being the amount of capital expenditure during the year. In view of the extended operations of the company, your directors have decided to create a contingent reserve of $1,000,000. The reserves for federal and provincial taxes require the enormous sum of $2,474,769. After deducting these items from the amount of net profits, as stated, and providing therefrom also dividends Nos. 42 and 43 (totaling $3,238,053) the remainder, $2,981,789, was added to the profit-and-loss account." The total of the dividends and the amount added to profit-and-loss, it will be noted, form the amount that the company computed as its net operating profit in 1925.

## De Pencier Sees Two Years' Ore at Dome

In his report for the year ended Dec. 31, 1926, H. P. De Pencier, general manager of Dome Mines, Ltd., is not optimistic over the outlook. Regarding the company's operations in the Porcupine district, in northern Ontario, he says:

"As anticipated in last year's report, the development work has failed to open up a tonnage of ore nearly equal to that milled during 1926, and the indications do not leave us much hope that the coming year will see any improvement in this respect, unless the development campaign discloses larger orebodies than those that have been found in the last couple of years. The broken ore in the stopes has been reduced somewhat and now stands at 575,000 tons. This will undoubtedly be farther drawn on during 1927. While it is impossible to measure the ore remaining unbroken in most places, it is believed that two years' ore at the present rate of crushing remains; this includes the broken ore."

Operating costs amounted to $4.167 per ton milled, compared with $4.467 during the preceding year. The reduction is accounted for partly by the decrease in the broken-ore reserve, although this in turn has been offset to some extent by the higher cost of mining from small shoots on intermediate levels. Mill results were:

| | |
|---|---|
| Tons milled | 555,700 |
| Average value per ton | $7.28 |
| Amalgam bullion, per ton ore | 4.28 |
| Cyanide bullion, per ton ore | 2.81 |
| Total recovery | 7.09 |
| Extraction, per cent | 97.33 |
| Milling cost, per ton | $0.90 |

The directors report a net excess of current assets over current liabilities, after paying of the dividend paid on Jan. 20, amounting to $3,234,279, of which $2,219,431 has been set apart as a dividend assurance fund. Following is the earnings statement for 1926:

**Dome Earnings**

| | |
|---|---|
| Amalgamation bullion | $2,380,118.43 |
| Cyanidation bullion | 1,559,971.70 |
| | $3,940,090.13 |
| Non-operating revenue | 251,510.61 |
| Total | $4,191,600.74 |

**Dome Operating and Maintenance Expenditure**

| | | |
|---|---|---|
| Mining, including hoisting | $717,036.17 | |
| Development | 757,706.94 | |
| Crushing and conveying | 80,615.45 | |
| Milling | 500,891.30 | |
| Bullion expense | 20,866.90 | |
| Fire protection | 9,121.83 | |
| Warehouse expense | 10,093.22 | |
| Auditors' expense | 2,645.13 | |
| Administrative expense— mine office | 117,754.36 | |
| Administrative expense— executive office | 20,425.09 | |
| Provincial and municipal taxes | 53,476.47 | |
| Insurance | 25,167.31 | |
| Total | $2,315,800.17 | |
| Reserve for Dominion and U. S. income war tax | 90,966.33 | |
| | | $2,406,766.50 |
| Profit for the year | | $1,784,834.24 |

## San Francisco Mines of Mexico Earned £300,791 in 1926

Operations of San Francisco Mines of Mexico, centering in the Parral district of Chihuahua, Mexico, netted a profit of £300,791 during the fiscal year ended Sept. 30, 1926, according to the report just issued. Production and earning statistics are shown in the accompanying table. The directors attribute the success of operations to the excellent work of the general manager, E. A. Strout, and his staff in Mexico.

During the year the new South shaft was sunk to the fifth level and underground electric haulage facilities were provided, which has allowed development to be pushed on at a more rapid rate. Greater vein widths were developed on the sixth and seventh levels than for corresponding sections above, while the grade improved with the increased widths. The Carbonate mill, an annex to the Sulphide mill, was completed in April last, treating during the remainder of the financial year 46,030 tons of zinc residues from earlier milling operations, which resulted in the recovery of 1,813 tons of lead and 11,359 tons of zinc concentrates. In 1925 the company secured an interest in the Reforma-Clarines group of mines, situated about 4 miles from the present operations, and, in accordance with the terms of the agreement, the Compania Minera de Clarines, S. A., has been locally registered, the San Francisco having the right to acquire a 75 per cent interest in the undertaking, and the right to control and develop the mine, both for a period of three years. In September the necessary plant to unwater the mine and allow of driving on the veins below the old workings was erected. Ore reserves on the San Francisco mine are estimated at 717,600 tons. The table follows:

| Year to Sept. 30 | Tons Milled | Concentrates in Tons Lead | Concentrates in Tons Zinc | Revenue £ | Dividend £ | Dividend % |
|---|---|---|---|---|---|---|
| 1923 | 88,663 | 22,244 | 16,159 | 137,256 | 112,690 | 15 |
| 1924 | 133,590 | 26,169 | 28,010 | 285,752 | 244,355 | 32½ |
| 1925 | 148,580 | 20,875 | 28,108 | 336,852 | 281,932 | 37½ |
| 1926 | 159,030 | 19,418 | 37,711 | 343,558 | 300,791 | 40 |

## Hollinger Output Declines $1,000,000 to $14,780,636 for 1926

The annual report of the Hollinger Gold Mines, of Porcupine, Ont., for 1926 shows that 1,932,559 tons averaging $7.99 were milled, the recovery amounting to $14,780,636. This is a slight increase in tonnage but a decrease of $1,000,000 in total production. Total charges were $7,630,879, an average of $3.95 a ton, a decrease of 10c. a ton as compared with 1925. Dividends paid during the year were $5,805,600, as compared with $4,378,200. The company showed an operating profit of $8,025,921, and after allowance for dividends and deducting taxes and depreciation $394,079 was carried over to surplus. Current assets are shown at $11,986,458, compared with $5,564,493 in 1925. This increase is accounted for by the inclusion of $5,125,000, which represents the value of the bonds and stocks for the sale of the company's power plant at Island Falls to the Abitibi company.

Development during the year amounted to 2,334 ft. of shaft sinking, 35,571 ft. of drifting, 44,851 ft. of crosscutting, and 570 ft. of raising. Broken ore in the stopes amounts to 1,120,000 tons and total ore reserves are estimated at 7,779,234 tons, having an average estimated value of $8.49, a total of $66,081,733, an increase of $1,000,000.

## Statistical Notes

**American Metal Co.**, operating in the United States and Mexico, reports a net income of $2,657,309 for 1926, compared with $3,353,866 for the preceding year. The following figures summarize the financial results of the two years:

| | 1926 | 1925 |
|---|---|---|
| Net operating income | $4,498,897 | $5,296,109 |
| Depreciation and exploration | 1,694,040 | 1,606,956 |
| Special deductions | 147,548 | 335,287 |
| Net income | $2,657,309 | $3,353,866 |
| Dividends, preferred | 350,000 | 350,000 |
| Dividends, common | 2,376,003 | 1,926,775 |
| Surplus | (a) $68,694 | $1,077,091 |

(a) Deficit.

Carl M. Loeb, president, says: "Notwithstanding the large consumption of non-ferrous metals during 1926, prices in general have declined and earnings of the company have been adversely affected. Returns from the company's Mexican operations, in particular, have been curtailed by substantial drop in lead and silver prices.

"Your company acquired controlling interest in the Pecos mine, in New Mexico, under contract to equip the property. Construction work has been completed and operations were started at the beginning of this year. The property is expected to attain monthly production of 5,000 tons of zinc concentrates and 1,500 tons of lead concentrates."

**Pig iron duties** have been increased under the flexible provisions of tne Tariff Act by the President. The increase amounts to 37½c. per ton. The action was taken as the result of a cost investigation by the Tariff Commission. The President found that the existing duty of 75c. a ton did not equalize the differences in the costs of production in the United States and in British India, the principal competing country. The new duty rate on pig iron will be $1.125 a ton.

**Santa Gertrudis Co., Ltd.**, operating in the Pachuca district in Mexico, has continued operations at the capacity of its plants, despite the decline in silver. For the quarter ending Dec. 31, 1926, the mills handled 186,178 tons of ore, giving a net revenue, before making deductions for depletion and depreciation, of $384,225.

## Imports and Exports of Ores and Metals in January, 1926 and 1927

Compiled from U. S. Department of Commerce Records

In pounds unless otherwise stated

### Imports

| | January 1926 | January 1927 |
|---|---|---|
| **Antimony** | | |
| Ore: Gross weight | 143,161 | 54,320 |
| Ore: Antimony content | 111,491 | 30,120 |
| Liquated regulus or metal | 3,190,513 | 2,465,512 |
| **Copper** | | |
| Ores | 13,094,320 | 16,948,089 |
| Concentrates | 798,461 | 3,330,590 |
| Regulus, coarse metal and cement copper | 64,240 | 32,500 |
| Imported from | | |
| Spain | 1,703,550 | 2,121,005 |
| Canada | 7,551,165 | 3,952,549 |
| Mexico | 692,921 | 5,062,150 |
| Cuba | ..... | 2,160,000 |
| Chile | 3,633,199 | 5,725,003 |
| Peru | 48,236 | 1,110,738 |
| Other countries | 327,950 | 179,734 |
| Unrefined black, blister and converter copper in pigs, bars, and other forms | 36,354,032 | 30,698,746 |
| Refined copper | 13,786,315 | 13,402,158 |
| Old and clippings for remanufacture | 532,178 | 445,937 |
| Composition metal, copper chief value | 10,980 | 11,200 |
| **Brass** | | |
| Old and clippings for remanufacture | 443,501 | 523,017 |
| **Lead** | | |
| Ore and matte | 7,917,254 | 11,360,219 |
| Bullion or base bullion | 8,556,203 | 12,608,647 |
| Pigs and bars | ..... | ..... |
| Scrap lead, babbitt, solder and other forms | 112,564 | 119,492 |
| Type metal and antimonial lead: Gross weight | 298,462 | 378,510 |
| Type metal and antimonial lead: Lead content | 142,742 | 295,953 |
| **Manganese** | | |
| Ore, tons: Cuba, gross weight | 4,500 | ..... |
| Ore, tons: Other countries, manganese content | 37,421 | ..... |
| Pyrites, tons | 63,210 | 17,846 |
| **Tin** | | |
| Ores, tons | 15 | 9 |
| Bars, blocks, and pigs | 15,749,339 | 17,842,996 |
| Imported from | | |
| Netherlands | 1,043,546 | 2,077,041 |
| United Kingdom | 4,831,600 | 1,756,312 |
| British Malaya | 9,211,956 | 12,832,196 |
| Dutch East Indies | ..... | 175,046 |
| Hongkong | 448,671 | 381,256 |
| Australia | 151,320 | 112,000 |
| Other countries | 62,246 | 509,145 |
| **Zinc** | | |
| Ore, zinc content: Free | ..... | ..... |
| Ore, zinc content: Dutiable | 425,113 | 5,678,297 |
| Blocks, pigs and old | 2,445 | 2,285 |

### Exports

| | January 1926 | January 1927 |
|---|---|---|
| **Copper** | | |
| Ores, concentrates, composition, and unrefined | 3,265 | 572,165 |
| Refined in ingots, bars, and other forms | 62,416,511 | 78,126,677 |
| Exported to | | |
| Belgium | 6,976,403 | 8,126,930 |
| France | 22,672,521 | 5,516,682 |
| Germany | 6,374,771 | 19,017,276 |
| Italy | 4,570,373 | 9,300,940 |
| Netherlands | 2,490,495 | 6,311,314 |
| Spain | 728,800 | 380,446 |
| Sweden | 986,898 | 1,596,285 |
| United Kingdom | 12,516,368 | 20,795,158 |
| Other Europe | 352,400 | 651,143 |
| Canada | 2,043,601 | 1,456,455 |
| British India | ..... | 819,661 |
| China, Hongkong and Kwantung | 504,000 | 492,800 |
| Japan | 1,307,803 | 3,247,471 |
| Other countries | 892,078 | 414,116 |
| Old and scrap | 469,797 | 3,375,793 |
| Pipes and tubes | 247,066 | 181,836 |
| Plates and sheets | 671,723 | 1,079,267 |
| Rods | 2,919,823 | 4,025,678 |
| Wire | 568,000 | 967,812 |
| Insulated copper wire and cable | 1,134,990 | 1,450,901 |
| **Lead** | | |
| In pigs, bars, and other forms | ..... | ..... |
| From domestic ore | 56,693 | 189,918 |
| From foreign ore | 12,194,699 | 11,699,444 |
| Exported to | | |
| Belgium | 1,232,362 | ..... |
| France | 3,136,723 | 336,074 |
| Germany | 1,075,580 | 2,576,483 |
| Netherlands | 167,435 | 784,190 |
| Sweden | 224,168 | 806,702 |
| United Kingdom | 3,473,316 | 3,979,305 |
| Other Europe | 112,532 | 1,010 |
| Brazil | 448,180 | 560,089 |
| Other South America | 939,127 | 1,503,741 |
| Japan | 448,106 | 560,268 |
| Other countries | 993,863 | 781,500 |
| Other lead manufactures | 3,072,075 | 2,540,539 |
| **Zinc** | | |
| Ore and concentrates, tons | 7,553 | 9,724 |
| Dross | 2,304,830 | 1,069,120 |
| Cast in slabs, blocks, or pigs | 1,444,178 | 5,663,818 |
| Exported to | | |
| Belgium | ..... | 100,184 |
| France | 874,316 | 179,276 |
| Germany | 86,696 | 324,890 |
| Italy | 280 249 | 392 097 |
| Netherlands | ..... | 103,196 |
| United Kingdom | ..... | 3,415,768 |
| Other Europe | 156,845 | 235,243 |
| Other countries | 46,078 | 913,164 |
| Sheets, strips other forms | 791,251 | 627,074 |
| Dust | 206,101 | 274,595 |
| Other zinc manufactures | 603,196 | 202,08 |

# The Market Report

## Copper Touches New High for Year

### Demand Somewhat Quieter But Prices Advance—Lead Also Active and Higher

**New York, March 2, 1927**—Copper reached 13⅜c. for Connecticut deliveries yesterday, the highest price since Dec. 29, though sales the last few days have not been heavy. Lead had another active week, and today the leading seller advanced New York quotations 15 points to 7.55c. Zinc has been quieter at practically unchanged prices, and prompt Straits tin, after touching 71c. last Friday, the highest price in three months, has tapered off a little in the last three days. Silver is also a little lower than last week. Metal producers, in general, are the most optimistic that they have been since the first of the year. An excellent spring demand is in prospect, and the course of the stock market recently does not indicate that there are any clouds on the horizon. Foreign industrial conditions are also apparently improving.

### Copper Now 13⅜c.

There has been surprisingly little difference in copper quotations by the various sellers in the last week. On Thursday practically all business was done at 13¼c. in the East and 13¼c. in the Middle West. On the next two days prices ranged from these levels up to ¼c. higher. On Monday practically all sellers were at 13¼c., Valley; and yesterday and today 13⅜c. has been done, at which level all the producers are now resting. Most of the business has gone to two sellers during the week; some of the others have sold so heavily recently that they are virtually out of the market except to regular customers. Time of shipment has ranged well from prompt to May. Brass mills have been the chief buyers; wire mills have recently shown little interest.

Though the recent rise in copper prices is generally attributed to reports of a policy of curtailed production having been adopted by some of the large producers, a more sound reason would seem to be the heavy buying that has taken place during February. Though the shortest month of all, it is probable that more copper was purchased in the month just ended than in any other month for the last year. This naturally puts sellers' order books in a most satisfactory position and causes them to be unwilling sellers except on an advancing market. Foreign buying was also excellent, the export association booking around 60,000 tons.

The answer to the question whether prices will be maintained or advanced, or will again slump back depends largely on whether this buying interest will continue, being based on improved consumption of the metal, or whether manufacturers have merely booked copper farther ahead than usual, having been attracted by low prices, a condition which would make for a quiet market in March and early April.

Production, of course, enters into the question, as well as consumption. Rumors have been current that the porphyries and some other large producers of copper would make an immediate curtailment in production, but an editorial canvass of some of the leading interests fails to bring out any definite

### Average Metal Prices for February, 1927

| | |
|---|---|
| **Copper:** | |
| New York Electrolytic | 12.682 |
| London Standard Spot | 54.438 |
| London Electrolytic Spot | 61.119 |
| **Lead:** | |
| New York | 7.420 |
| St. Louis | 7.286 |
| London Spot | 27.356 |
| London Forward | 27.781 |
| **Silver:** | |
| New York | 57.898 |
| London | 26.854 |
| Sterling Exchange | 484.551 |
| **Zinc:** | |
| St. Louis | 6.673 |
| London Spot | 29.931 |
| London Forward | 30.109 |
| **Tin:** | |
| 99 per cent | 66.528 |
| Straits | 69.142 |
| London | 306.125 |
| **Quicksilver** | 101.727 |
| **Antimony** | 14.509 |
| **Platinum:** | |
| Refined | 107.545 |
| Crude | 99.295 |
| **Aluminum,** 98 per cent | 26.000 |

### Daily Prices of Metals

| Feb. Mar. | Copper | Tin | | Lead | | Zinc |
|---|---|---|---|---|---|---|
| | Electrolytic, N. Y. | 99 Per Cent | Straits | N. Y. | St. L. | St. L. |
| 24 | 12 90 | 67.50 | 70 375 | 7.40 | 7.30@7.325 | 6 80@6 825 |
| 25 | 12 975 | 68 25 | 71.00 | 7.425 | 7.325 | 6 825@6 85 |
| 26 | 12 975 | 68 125 | 70 75 | 7.45 | 7.325 | 6 85 |
| 28 | 13 025 | 68 00 | 70 50 | 7.45 | 7.35 | 6.825@6.875 |
| 1 | 13.15 | 67 00 | 69 50 | 7.475 | 7.35 | 6.80 |
| 2 | 13.15 | 67 125 | 69.375 | 7.55 | 7.40 | 6.80@6.825 |
| Av. | 13.029 | 67 667 | 70 250 | 7.458 | 7.344 | 6.827 |

Average prices for calendar week ending February 26, 1927, are: Copper, 12.905c.; 99 per cent tin, 67.675c.; Straits, 70.475c.; N. Y. lead, 7.420c.; St. L. lead, 7.313c.; zinc, 6.833c.; and silver, 57.300c.

The above quotations are our appraisal of the major markets for domestic consumption based on sales reported by producers and agencies. They are reduced to the basis of cash, New York or St. Louis, as noted. All prices are in cents per pound.

Copper, lead, and zinc quotations are based on sales for both prompt and future deliveries; tin quotations are for prompt delivery only.

In the trade, copper prices usually are quoted on a delivered basis; i.e., delivered at consumer's plant. As delivery and interest charges vary with the destination, the figures shown above are net prices at refineries on the Atlantic seaboard.

Quotations for copper are for ordinary forms of wire bars, ingot bars, and cakes. For ingots an extra 0.05c. per pound is charged and there are other extras for other shapes. Cathodes are sold at a discount of 0.125c. per lb.

Quotations for zinc are for ordinary Prime Western brands. Zinc in New York is now quoted at 0.35c. per pound above St. Louis, this being the freight rate between the two points.

Quotations for lead reflect prices obtained for common lead, and do not include grades on which a premium is asked.

### London

| Feb. March | Copper | | | Tin | | Lead | | Zinc | |
|---|---|---|---|---|---|---|---|---|---|
| | Standard | | Electrolytic | | | | | | |
| | Spot | 3M | | Spot | 3M | Spot | 3M | Spot | 3M |
| 24 | 55⅝ | 56⅛ | 62 | 311¼ | 301½ | 28 1/16 | 28 7/16 | 30⅜ | 30⅞ |
| 25 | 56⅜ | 56⅞ | 62 1/4 | 314¾ | 304½ | 28⅛ | 28½ | 30¾ | 31 |
| 28 | 56 3/4 | 57¼ | 62¾ | 315 | 304 | 28½ | 28¾ | 31 | 31 5/16 |
| 1 | 56⅛ | 56⅝ | 62¾ | 311¼ | 299 | 28⅜ | 28¾ | 30⅝ | 30⅞ |
| 2 | 56⅛ | 56¾ | 62¼ | 313¼ | 300⅜ | 28 7/16 | 28 13/16 | 30¾ | 31 1/16 |

The above table gives the closing quotations on the London Metal Exchange. All prices in pounds sterling per ton of 2,240 lb.

### Silver, Gold, and Sterling Exchange

| Feb. | Sterling Exchange "Checks" | Silver | | Gold London | Feb. Mar. | Sterling Exchange "Checks" | Silver | | Gold London |
|---|---|---|---|---|---|---|---|---|---|
| | | New York | London | | | | New York | London | |
| 24 | 4.84 9/16 | 57¼ | 26 9/16 | 84s11½d | 28 | 4 84½ | 56⅛ | 26⅛ | 84s11½d |
| 25 | 4 84⅝ | 57⅛ | 26 9/16 | 84s11½d | 1 | 4 84⅝ | 56½ | 26¼ | 84s11½d |
| 26 | 4.84⅝ | 57¼ | 26⅝ | . . . | 2 | 4.84⅝ | 56⅛ | 26 1/16 | 84s11½d |
| | | | | | Avg. | | 56.729 | | |

New York quotations are as reported by Handy & Harman and are in cents per troy ounce of bar silver, 999 fine. London silver quotations are in pence per troy ounce of sterling silver, 925 fine. Sterling quotations represent the demand market in the forenoon. Cables command one-half cent premium.

confirmation of these rumors, and until something more material than gossip is offered, they should be taken with several grains of salt. The nearest approach to a confirmation of a curtailment policy is contained in a telegram from D. C. Jackling to the *E. & M. J.* which states that "the copper mines under my direction in Utah, Nevada, Arizona, and New Mexico reduced their production some time ago to a degree which will result as a whole in metal output for the full month of February approximating 90 per cent of the average monthly rate of the same group for the fourth quarter of 1926. Production for future months will be governed by demand and price for the copper output by these mines, and cannot be so closely foretold." Anaconda, by shutting down its Mountain View and Stewart mines, has probably decreased its Butte production by 2,000 tons a month but this is offset by new production by Andes.

## Smelting Company Marks Up Lead

Effective today, March 2, American Smelting & Refining Co. increased its official contract price for common lead in New York from 7.40c. to 7.55c. This marks the end, for the time being at least, of a steady decline from 8.90c. that began Sept. 13, 1926. The last occasion upon which the Smelting company increased its price was on July 30, 1926, when an advance from 8.75c. to 8.90c. was made. Usually the price of lead fluctuates in long swings, and if this habit is persisted in, a period of steady appreciation is in prospect. Lead in London has been advancing with fair consistency for about two months, though a slight decline has followed the high point reached on Monday, Feb. 28. For more than a week producers of Mexican ore lead could have marketed their product more advantageously in the foreign than in the domestic market. This is a situation which had not existed since July, 1926. In addition to strength in London, brisk buying in the domestic market, particularly in the Middle West, has been an element of strength.

Until today fair tonnages of metal have been sold in New York at prices ranging from 10 to 15 points above the Smelting company figure. In quoting the market, specification sales against contract must be set against those that brought higher prices. In the Middle West the leading interest supplied regular customers at 7.30c. until Monday, when the price was marked up by from 2½ to 5 points. Its price today is 7.40c. The demand has been mostly for March delivery, with some prompt and some for April. Buyers represent nearly all lines of manufacturing activity, with the so-called "small" buyers showing keen interest. Whether the turn in the trend of the market will stimulate still more active buying remains to be seen. Most of the sellers have comparatively small stocks of the metal for March shipment; but if the large consumers are fairly well provided for, the supply ought to be adequate. Corroding grades are in good demand at the usual premiums of $2 and $3 per ton.

**Correction** — Information just to hand is to the effect that an error was made in the price of London forward lead cabled to this country on Dec. 16. The correct figure was £29¼ instead of £29½. The December average is therefore 29.264, instead of 29.259; the yearly average is unaffected.

## Break in Tin

A revision of published estimates of Straits tin shipments, together with speculative dealing in London, caused a break in the domestic tin market on Tuesday. Ten days ago March shipments were estimated at about 5,300 tons, but subsequently this was changed to somewhere between 7,000 and 7,200. Both January and February showed declines in visible supplies, but with better prospects for March it is not improbable that lower prices will rule. Domestic buying has been dominated by dealers and speculators, thought some metal has been sold into consumption.

## Zinc Quieter

A fair busines has been done in zinc, but not equal to that of last week, as galvanizers continue uninterested. This seems to be attributable more to a lack of orders for finished material than to any idea that the price of zinc is too high. Prices have ranged between 6.80 and 6.875c., St. Louis, all week, being 6.80@6.825c. today. High-grade continues at 8¼c. delivered in the East on an occasional carload. New York prices on Prime Western are 35c. per 100 lb. above St. Louis.

## Silver Closes at 56⅛c.

According to reports from London, India and China continue their operations of last week, the former buying and the latter selling. London also advises sales from Continental sources. In New York the volume of buying orders from India has increased somewhat at the lower price level, but the market tendency is uncertain.

**Mexican Dollars** (old Mexican pesos): Feb. 24th, 43⅜c.; 25th, 43¼c.; 26th, 43⅜c.; 28th, 42⅝c.; March 1st, 43c.; 2d, 42⅝c.

## Foreign Exchanges Steady

Foreign exchanges show little change from last week, closing cable quotations on Tuesday, March 1, being: francs, 3.91¼c.; lire, 4.38c.; and marks, 23.70½c. Canadian dollars, ¼¼ per cent discount.

## Zinc and Lead Ore Higher

**Joplin, Mo., Feb. 26, 1927**

**Blende**

| | |
|---|---|
| High | $49.80 |
| Premium blende, basis 60 per cent zinc | $46.00@ 47.50 |
| Prime Western, basis 60 per cent zinc | 45.00@ 46.00 |
| Fines and slimes, 60 per cent zinc | 41.00@ 40.00 |
| Average settling price, all zinc | 43.79 |

**Galena**

| | |
|---|---|
| High | $98.40 |
| Basis 80 per cent lead | 97.50 |
| Average settling price, all lead | 96.49 |

Shipments for the week: Blende, 17,195; calamine, 32; lead, 2 256 tons. Value, all ores the week, $972,780.

Shipments for two months: Blende, 98,841; calamine, 298; lead, 16,127 tons. Value, all ores two months, $5,916,670.

Purchasing agents were sparring for ore on a basis reported $45 for Prime Western, with some agents, fearing a shortage on filling orders, buying on a $46 basis.

Early buying this week advanced lead prices $2.50 per ton, and other advances followed, closing the week on $97.50 basis, $7.50 higher than last week.

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**Platteville, Wis., Feb. 26, 1927**

| Zinc Blende | Per Ton |
|---|---|
| Blende, basis 60 per cent zinc | $46.75 |
| **Lead Ore** | |
| Lead, basis 80 per cent lead | $96.00 |

Shipments for the week: Blende, 1,237 tons; lead, none. Shipments for the year: Blende, 11,033; lead, 340 tons. Shipments for the week to separating plants, 2,511 tons blende.

## Steel Prices Harden—Pig Iron Dull—Coke Quiet

**Pittsburgh, March 1, 1927**

Steel prices are showing more resistance to declines. Large mills are making a strong effort to establish 2.00c. as the small-lot price on bars and shapes, to protect 1.90c. as the large-lot price. Strip makers have announced advanced prices, at 2.30c. for under 6 in. and 2.10c. for 6 in. and wider, these prices being about halfway between prices of three or four months ago and the recent low prices.

**Pig Iron** — The Valley market remains dull, with prices strictly held at $19 for bessemer, $18 for basic, and $18.50 for foundry, f.o.b. furnaces.

**Connellsville Coke** — There are no contract negotiations, and spot coke remains quiet, with prices unchanged at $3.35@$3.50 for furnace and $4.25@ $4.75 for foundry.

## Other Metals

**Quotations cover large wholesale lots, f.o.b. New York, unless otherwise specified. London prices are according to latest mail advices.**

**Aluminum**—Per lb., 99 and 98 per cent grades, price of leading interest, 26c.; outside market, 25.30@26c. Market gradually improving, but buyers are cautious and refuse to specify very far ahead. London, 98 per cent, £105@ £107 per long ton for domestic consumption.

**Antimony**—Per lb., duty paid, spot: Chinese brands, 14@13½c.; April, about ½c. lower. Cookson's "C" grade, spot, 17½c.

Chinese needle, lump, 8c. Standard powdered needle, 200 mesh, 10c. White oxide, Chinese, 99 per cent $Sb_2O_3$, 16½c. Nominal.

**Bismuth**—Per lb., in ton lots, $2.70@ $2.75. London, 10s.

**Cadmium**—Per lb., 60c. London, 1s. 10d. for Australian metal.

**Cobalt**—F.o.b. Canadian works, per lb., shot, 96@98 per cent, $2.50@$2.60. Black oxide, 70 per cent, $2.10. London, 8s. 6d.@10s. for metal; 8s. for black oxide; 8s. 10d. for gray.

**[1]Germanium Oxide**—Per gm. in 300- to 500-gm. lots, $5.

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[1]Price furnished by Foote Mineral Co., Philadelphia.

**Iridium** — Per oz., $115 for 98@99 per cent sponge and powder. London, £32½ in iridio-platinum; £17@£19, nominal, for sponge and powder.

[1]**Lithium**—Per lb., 95@96 per cent grade in 1- to 5-lb. lots, $65.

**Magnesium**—Per lb., in ton lots, 8-lb. ingots (3x3x15 in.), 75c.; 3-lb. sticks (1⅜x33 in.) 80c.; 10-oz. sticks, (1x12 in.), 90c. Market firm. Increasing demand reported for light alloys. London, 3s. 9d.@4s. 3d. for 99 per cent ingots or sticks.

[1]**Molybdenum**—Per kg., 99 per cent, $25; C. P. metal, $80.

**Monel Metal**—Base price for shot, 32c. per pound.

**Nickel** — Per lb., ingot, 35c.; shot, 36c.; electrolytic. 39c. (99.75 per cent grade), for single lots of spot metal. London, £170@£175 per long ton according to quantity. Demand continues good.

**Osmium**—Per oz., $55@$60; London, £15@£18.

**Palladium**—Per oz., $59@$62. Small lots bring up to $68. Pure metal as a constituent of crude platinum, $55@$59 per oz. London, £11@£12, though nominal prices are higher.

**Platinum** — Official price on refined metal, $108 per oz. Open market cash sales of large lots at $101@$103. Pure metal as a constituent of crude platinum, $100@$101. Market very dull.

London, £21 per oz. for refined, and £18½@£19½ for crude and scrap. Dull.

**Quicksilver**—Per 75-lb. flask, $101@$103. San Francisco wires $101. London, firm at £17 10s.

**Radium**—Per mg. radium content, $70.

**Rhodium**—Per oz., $55@$60; London, £9½@£13. Nominal.

**Ruthenium** — Per oz., $40, nominal. London, £7½@£10.

**Selenium** — Black, powdered, amorphous, 99.5 per cent pure, $1.90@$2 per lb. in ton lots. London, 7s. 6d.@7s. 8d.

**Tellurium**—Per lb., $2.

[1]**Thallium Metal**—Ingot, 99 per cent pure, $15 per lb. in 25-lb. lots.

**Tungsten Powder**—Per lb., 97 to 98 per cent pure, $1.05.

[1]**Zirconium Metal**—Per lb., 98 per cent grade, $30 in 5- to 10-lb. lots.

## Metallic Ores

**Chrome Ore**—Per net ton, f.o.b. eastern shipping points, $21.50@$23.50 for 45 to 50 per cent $Cr_2O_3$ ore. Prices firm.

**Iron Ore**—Lake Superior ores, per long ton, lower Lake ports; prices are for 1926 season; new prices are not likely to be established for another month.

Mesabi, non-bessemer, 51½ per cent iron, $4.25. Old Range, $4.40.

Mesabi, bessemer, 51½ per cent iron, $4.40. Old Range bessemer, 51½ per cent, $4.55.

High-phosphorus foundry, over 0.18 per cent P, $4.15.

Eastern ores, cents per unit, delivered at furnaces: Foundry and basic, 53 to 63 per cent, 9@10½c.

Foreign ores, f.o.b. cars Atlantic ports, cents per unit:

Swedish and Norwegian. low-phosphorus, 68 per cent, 10¼@10⅜c.

Spanish low-phosphorus, 52@54 per cent, 10@11c.

Algerian, low-phosphorus, 9¼@9⅜c.

Spanish foundry or basic, 50@54 per cent, 8⅜@9¼c.

Swedish foundry or basic, 66@68 per cent, 9@9½c.

**Manganese Ore**—Per long ton unit of Mn, c.i.f. North Atlantic ports, minimum 47 per cent Mn, 36@38c. Caucasian (washed), 53@55 per cent, 38@40c.

[1]Chemical grades, powdered, coarse or fine, 82@87 per cent $MnO_2$, Brazilian and Cuban, $70@$80 per ton in carloads.

**Molybdenum Ore**—Per lb. of $MoS_2$ for 85 per cent $MoS_2$ concentrates f.o.b. *Colorado*, 48@50c.

**Tantalum Ore** — Nominally 45c. per lb. of $Ta_2O_5$ for ore containing 60 per cent $Ta_2O_5$.

**Titanium Ore**—Ilmenite, 52 to 60 per cent $TiO_2$, f.o.b. Atlantic seaboard, $10@$18 per gross ton, according to grade and impurities. Low-grade, domestic, 32 to 35 per cent, about $7@$8 per gross ton. Rutile, 96 per cent concentrate, 11c. to 13c. per lb.

**Tungsten Ore**—Per unit of $WO_3$, N.Y.: Wolframite, $10.75@$11; Western scheelite, $11.25@$11.50.

**Uranium Ore**—Minimum 5 per cent $U_3O_8$ per lb. of $U_3O_8$ contained, nominal at $5, f.o.b. Montrose, Colo.

**Vanadium Ore**—Containing 5 per cent $V_2O_5$, nominal at 25c. per lb. of $V_2O_5$, f.o.b. Montrose, Colo.

Foreign concentrate (lead vanadate) 12 to 18 per cent $V_2O_5$, 55@60c. per pound $V_2O_5$, duty paid, seaboard. Nominal.

## Non-Metallic Minerals

Prices received for non-metallic minerals vary widely and depend upon the physical and chemical characteristics of the commodity. Hence the following quotations can serve only as a general guide to the prices obtained by producers and dealers in different parts of the United States for their own product. In the last analysis the value of a particular non-metallic mineral can be ascertained only by direct negotiation between buyer and seller.

[1]**Amblygonite**—8@9 per cent lithium oxide, $50@$60 per ton, f.o.b. mines.

**Asbestos**—F.o.b. *Quebec* mines, tax and bags included, per ton:

Crude No. 1, $525; crude No. 2, $325; spinning fibers, $200; magnesia and compressed sheet fibers, $125@$150; shingle stock, $80; paper stock, $40@$45; cement stock, $25; short fibers, $10@$17.50; floats, $15. Active market for all spinning grades, but medium and short grades are quiet.

No. 1 Rhodesian crude, $325: No. 2, $250@$300 per ton, c.i.f. New York.

**Barytes**—F.o.b. mines, bags extra:

*Georgia:* Barytes ore, crude, per long ton, $7.25@$8. Wet ground, off-color, $12@$18, depending on analysis. Market fair.

*Missouri:* Water ground and floated, bleached, $23; $25 in less than car lots, f.o.b. works. Crude ore, 93 per cent $BaSO_4$, not to exceed 1 per cent iron, per ton, $8, f.o.b. mines. Market good.

**Bauxite**—No. 1 chemical ore, over 60 per cent $Al_2O_3$, less than 5 per cent $SiO_2$, and less than 2 per cent $Fe_2O_3$, $8 per long ton, f.o.b. Georgia mines.

Foreign, per metric ton, c.i.f.: Dalmatian, low $SiO_2$, $5@$6.50; Istrian, $5.50@$7; French, red, $6@$7.50.

**Borax**—Carload lots, in bags, per lb.; crystals, 4¼c.; granulated or powdered, 4c.; f.o.b. plant, *Pennsylvania.*

[1]**Celestite**—90 per cent $SrSO_4$, finely powdered, $27 per ton in carload lots.

**Chalk**—Crude, in bulk, per ton c.i.f. New York, $4.75@$5.

**China Clay (Kaolin)**—F.o.b. *Virginia* mines, per ton; crude, lump, No. 1, $7; crude No. 2, $5.50; washed, $8; powdered and air-floated, $10@$15; ground, $7@$10.

*Florida*, pressed pottery, bulk, $13; ground, No. 1, $20; No. 2, $15. Sprayed mineral flour No. 1, $20; No. 2, $17.

1A grades, domestic, $16@$18, f.o.b. Delaware plants. Good demand.

Imported English, f.o.b. American ports: Lumps, $13@$21; powdered, $45@$50.

**Diatomite**—Per short ton, f.o.b. plant: Kiln-fired brick, $65; kiln-fired aggregate, ¼ in., $45; insulating powder, $30; natural aggregate, ¼ in., $20; air-floated powder, $40. Over 85 per cent silica, 98 per cent through 200 mesh, $15@$16 depending on quantity. Market good.

**Emery** — F.o.b. *Pennsylvania* and *New York* in 350-lb. kegs, per lb. Greek Naxos, 6½c.; Turkish, 6½c.; Khasia, 5½c.; domestic, 3½c. Market good.

**Feldspar** — F.o.b. mine or grinding plant:

*North Carolina:* No. 1 pottery grade, $6.50@$7.50 per long ton. Market good.

*New Hampshire:* Pottery grade, $8.25 per ton; soap grade, $8.75. Market fair.

*New York:* Per ton, f.o.b. cars, No. 1 crude, $9. Market good.

*Tennessee:* No. 1, pottery, 140 mesh, $16 per ton; 200 mesh, $18. No. 2, enamel, 140 mesh, $14; 200 mesh, $16. Demand good.

*Maine:* Pottery grade, ground, $19 per ton. Market fair.

**Fluorspar**—F.o.b. *Kentucky* and *Illinois* mines, per short ton:

Gravel, not less than 85 per cent $CaF_2$, and not over 5 per cent $SiO_2$, $18. Foundry lump, 85-5, $20. Ground, 95 to 98 per cent $CaF_2$, and not over 2½ per cent $SiO_2$, $32.50 in bulk; $36.50 in bags or barrels. Acid lump, 98-1, $30 in car lots. Market very dull, despite activity in steel production. Foreign competition is a factor.

*New Mexico:* 85-5 gravel, $16.50; 85-5 lump, $15.50; 93-3 lump, $19; 96-3, ground 100 mesh, $35, bulk; $40 bags. Market good.

Foreign spar, duty paid, $16.75@$17.25, tidewater.

**Fuller's Earth**—Per ton, f.o.b. *Florida:* 16 to 30 mesh, $16.50; 30 to 60 mesh, $18; 60 to 100 mesh, $15; 100 mesh "up," $8; 200 mesh "up," $15. Market fair at unchanged prices.

Powdered, imported, duty paid, $24@$25 per ton.

**Garnet** — Domestic, per ton f.o.b. mines, $85. Market easy.

Spanish grades, $60, c.i.f. port of entry.

**Gilsonite**—Per ton, carload lots, f.o.b. mines *Colorado:*

[1]Price furnished by Foote Mineral Co., Philadelphia.

selected grade, $33; seconds (mine run), $25.50.

**Graphite**—F.o.b. *New York*, per lb.: Ceylon lump, 8@9c.; chip, 7@8c.; dust, 3@6c.; Madagascar flake, 6½@7c. Market quiet, but prices firmer.

No. 1 flake, 10c. up; fine flake, 9c. up. Foundry facings, 4c. up. Amorphous, fine ground, 4c. up; fine ground crystalline, 5c. up. Crude amorphous graphite, $15@$35 per ton according to grade. Market dull and competition keen.

**Greensand**—Per ton, f.o.b. cars, *New Jersey:* screened and bagged, best grade in carload lots, $25. Market quiet.

**Gypsum**—Per ton f.o.b. mill, depending upon location: Crushed, $2.75@$3; ground, $4@$8; agricultural, $6@$12; calcined, $7@$10.

**Iron Oxide** (See Ocher)—Standard Spanish red, 2¾@4c. per lb.; domestic earth, 2@4½c.

**Kaolin**—See China Clay.

[1]**Lepidolite**—$20@$30 per ton for ordinary grades. Nominal.

**Limestone**—F.o.b. shipping points, depending on location: either lump or crushed, 75c.@$2 per ton.

**Agricultural, 75c. up to $4 or $5** for crushed or pulverized. Prices depend upon source, purity, and fineness.

**Magnesite**—Per short ton, f.o.b. *California* mines: Grade "A" calcined, 80 per cent through 200 mesh, $40; grade B, $38; dead burned, $33; crude, $14. F.o.b. eastern seaboard, calcined, $40. Market fair, with new business mostly for prompt delivery.

**Mica**—F.o.b. plant, per ton:

*New Hampshire:* Mine run, $360; clean shop scrap, $25; mine scrap, $20. White dry ground, 20 mesh, $28; 40 mesh, $35; 60 mesh, $55; 100 mesh, $70; 200 mesh, $85. Good demand, particularly for finer meshes.

*North Carolina:* White, ground, 20 mesh, $35; 70 mesh, $100.

Madagascar, amber, dark, free from iron, per lb., f.o.b. *New York*, duty paid: No. A1, $2.75@$3; No. 1, $2.60; No. 2, $2.30@$2.50; No. 3, $1.25; No. 4, 75c.; No. 5, 40@45c. Grades depend on size of sheets.

[1]**Monazite**—Minimum 6 per cent $ThO_2$, $120 per ton.

**Ocher**—F.o.b. *Georgia* mines, per ton: $22.50@$25 in sacks; $25@$30 in barrels: washed and water floated, $22@$25; second grade, 99 per cent through 225 mesh, $18. Market fair.

**Phosphate**—Per long ton, f.a.s. or f.o.b. mines:

*Florida*, pebble, f.a.s., for export: 76@77 per cent, $7; 75 per cent, $6.25; 74@75 per cent, $6; 70 per cent, $4.50; 68 per cent, $4.10; 66 per cent, $4. Prices firm.

*Florida*, pebble domestic: 76@77 per cent, $6.25; 75 per cent, $5.50; 74@75 per cent, $5.25; 72 per cent, $4.25; 70 per cent, $3.75. Market dull, on account of small buying by fertilizer manufacturers.

*Tennessee*, ground, 95 per cent through 100 mesh, basis 65 per cent B.P.L. (tri-calcium phosphate), $8 per short ton, with unit differential of 20c. per ton. Market slow. Lump rock for acid manufacturers, per gross ton, $5.75 on 75 per cent basis; $4.50 for 72 per cent basis.

**Potash**—The ruling contract prices are as follows:

| | Bags | Bulk |
|---|---|---|
| Muriate of potash 80 @ 85 per cent, basis 80 per cent.... | 36.40 | 34.80 |
| Sulphate of potash 90@95 per cent, basis 90 per cent.... | 47.30 | 45.70 |
| Sulphate of potash-magnesia 48@53 per cent, basis 48 per cent ..... | 27.25 | 25.65 |
| Manure salt 30 per cent.... | 21.75 | 18.75 |
| Manure salt 20 per cent..... | 15.40 | 12.40 |
| Kainit 14@16 per cent..... | 12.50 | 9.50 |
| Kainit 12.4 per cent..... | 12.00 | 9.00 |

Two thousand pounds net weight, c.i.f. Atlantic and Gulf ports. German weights, tares and analyses. Prices guaranteed against decline of German and French prices until April 30, 1927.

Discounts: 5 per cent on minimum of 50 tons $K_2O$; 6 per cent on 100 tons; 7 per cent on 300 tons; 10 per cent on 500 tons.

**Pumice Stone**—In barrels, per lb., powdered, 2½@4c.; selected lumps, 5@7c.

**Pyrites**—Tharsis, per long ton unit of sulphur, c.i.f. U. S. ports; guaranteed 48 per cent sulphur, furnace size, 2½-in. diameter, 13¾c. Cinder from ore to remain property of buyers. Good inquiry and outlook is better.

[1]**Quartz Rock Crystals**—Colorless, clear and flawed, pieces ½ to 1 lb. in weight, 40c. per lb. in ton lots. For optical purposes, double above prices.

**Silica**—Water ground and floated, per ton in bags f.o.b. *Illinois:* 400 mesh, $31; 350 mesh, $26; 250 mesh, $18. Market fair.

Glass sand, f.o.b. producing plant, 75c.@$5 per ton; molding sand, 65c.@$3.50; blast sand, $1.35@$3.50.

[1]**Spodumene**—$20@$30 per ton, depending upon lithium content. Nominal.

**Sulphur**—$18 per ton for domestic, f.o.b. *Texas* mines; $22 for export, Atlantic ports. Prices in reality are on a c.i.f. basis, but the average price reduced to an f.a.s. figure is about as given. Good shipment against contracts. Open prices $1 higher than above.

**Talc**—Per ton, carload lots, f.o.b. works, containers included:

*Vermont:* 99 per cent through 200 mesh, extra white, $10; 96 per cent through 200 mesh, medium white, $9; packed in 50-lb. paper bags. Strong competition; buyers' market.

*New York:* Double air-floated, 200 mesh, $13.75; 325 mesh, $14.75. Demand fair.

*Georgia:* Powdered, gray, $7.50@$10; yellow, $9@$12; red, $11@$13; roofing, $7.50@$9. Market fair.

*New Jersey:* Soapstone, ground, $10@$12; market good.

**Tripoli**—Per short ton, burlap bags, paper liners, minimum carload 30 tons, f.o.b. *Missouri:* Once ground through 40 mesh: rose and cream colored, $14. Double ground through 110 mesh: rose and cream, $17. Air-floated through 200 mesh: rose and cream, $25; mill run, $15. Business good.

[1]**Zircon**—Freight allowed east of Mississippi River; 95 per cent, 3c. per lb., f.o.b. mines, in carload lots.

[1]Price furnished by Foote Mineral Co., Philadelphia.

## Mineral Products

**Arsenious Oxide** (white arsenic)—3¾c. per lb. London, £17 per long ton for Cornish white.

**Calcium Molybdate**—$1.20 per lb. of contained Mo, delivered.

**Copper Sulphate** (blue vitriol)—4.80c.@5c. per lb., depending on quantity, for either large or small crystals. Good demand from Mexico and South America.

**Sodium Nitrate**—Crude, per 100 lb., ex vessel, Atlantic ports, $2.65 for spot; future delivery $2.66.

**Sodium Sulphate** (Salt Cake)—Per ton, bulk, f.o.b. works, $18@$20.

**Zinc Oxide**—Per lb. in bags, in car lots: Lead-free, 6½c.; 10, 20 or 35 per cent leaded grades, 6½c.; French red seal, 9⅜c.

## Ferro-Alloys

[1]**Ferrocerium**—Per lb., $5.50.

**Ferrochrome**—Per lb. of contained chromium, 60@70 per cent chromium, 4 to 6 per cent carbon, 10½@11c. Market active.

**Ferromanganese**—Domestic and foreign, 78@82 per cent, $100 per gross ton furnace, for delivery during first half of 1927. Spiegeleisen, 19@20 per cent, $36@$37 on carload business, f.o.b. furnace; 16@19 per cent, $34@$35. Heavier specifications against contracts.

**Ferromolybdenum**—Per lb. of Mo, f.o.b. shipping point, $1.25 on contract; $1.30 for spot.

**Ferrophosphorus**—Per ton, 18 per cent P, $91; electrolytic, 24 per cent, $122.50; f.o.b. *Alabama* and *Tennessee*.

**Ferrosilicon**—Per gross ton, f.o.b. works, freight allowed on carload lots east of Mississippi River: 50 per cent, $85; 75 per cent, $145; 14@16 per cent, $45. Active market.

**Ferrotitanium**—For 15 to 18 per cent material, $200 per ton, f.o.b. Niagara Falls, N. Y.

**Ferrotungsten**—Per lb. of W contained, $1@$1.05, f.o.b. works. Active but spotty.

[1]**Ferro-uranium**—30 to 40 per cent U, $4.50 per lb. of U contained, f.o.b. works in 500-lb. lots.

**Ferrovanadium**—Per lb. of V contained, f.o.b. works. $3.15@$3.75, depending on grade. Market active.

## Metal Products

**Rolled Copper**—Sheets, 22c.; wire, 15½c. per lb., f.o.b. mill.

**Lead Sheets**—Full rolled, 11c. per lb.; clipped, 11½c.

**Nickel Silver**—28¾c. per lb. for 18 per cent nickel Grade A sheets.

**Yellow (Muntz) Metal**—Dimension sheets, 19⅜c. per lb.; rods, 16⅜c. per lb.

**Zinc Sheets**—11c. per lb., f.o.b. works.

## Refractories

**Chrome Brick**—$45 per net ton, f.o.b. shipping point.

**Fireclay Brick**—First quality, $40@$43 per M., Ohio, Kentucky, Central Pennsylvania; second quality, $35@$40.

**Magnesite Brick**—9-in. straights, $65 per net ton, f.o.b. works.

**Silica Brick**—$40 per M., Pennsylvania and Ohio; $50 Alabama and Illinois.

[1]**Zirkite**—Powdered, 80 per cent $ZrO_2$, 2½c. per lb. Brick, straights, 80c.@$1 each.

# Metal Statistics

## Monthly Average Prices of Metals

### Silver

| | New York | | London Spot | | Sterling Exchange | |
|---|---|---|---|---|---|---|
| | 1926 | 1927 | 1926 | 1927 | 1926 | 1927 |
| January | 67.795 | 55.795 | 31.322 | 25.863 | 485.295 | 484.775 |
| February | 66.773 | 57.898 | 30.797 | 26.854 | 485.852 | 484.551 |
| March | 65.880 | ..... | 30.299 | ..... | 485.606 | ..... |
| April | 64.409 | ..... | 29.682 | ..... | 485.702 | ..... |
| May | 65.075 | ..... | 30.125 | ..... | 485.485 | ..... |
| June | 65.481 | ..... | 30.248 | ..... | 486.000 | ..... |
| July | 64.793 | ..... | 29.861 | ..... | 485.755 | ..... |
| August | 62.380 | ..... | 28.773 | ..... | 485.293 | ..... |
| September | 60.580 | ..... | 27.904 | ..... | 484.845 | ..... |
| October | 54.505 | ..... | 25.291 | ..... | 484.475 | ..... |
| November | 54.141 | ..... | 25.192 | ..... | 484.359 | ..... |
| December | 53.466 | ..... | 24.733 | ..... | 484.553 | ..... |
| Year | 62.107 | ..... | 28.686 | ..... | 485.268 | ..... |

New York quotations, cents per ounce troy, 999 fine. London, pence per ounce, sterling silver, 925 fine.

### Copper

| | New York | | London Spot | | | |
|---|---|---|---|---|---|---|
| | Electrolytic | | Standard | | Electrolytic | |
| | 1926 | 1927 | 1926 | 1927 | 1926 | 1927 |
| January | 13.822 | 12.990 | 59.013 | 55.414 | 65.325 | 62.375 |
| February | 13.999 | 12.682 | 59.669 | 54.438 | 66.375 | 61.119 |
| March | 13.859 | ..... | 58.603 | ..... | 65.489 | ..... |
| April | 13.706 | ..... | 57.200 | ..... | 64.600 | ..... |
| May | 13.599 | ..... | 56.494 | ..... | 64.313 | ..... |
| June | 13.656 | ..... | 56.778 | ..... | 64.591 | ..... |
| July | 13.924 | ..... | 57.864 | ..... | 65.625 | ..... |
| August | 14.174 | ..... | 58.857 | ..... | 66.857 | ..... |
| September | 14.062 | ..... | 58.705 | ..... | 66.528 | ..... |
| October | 13.862 | ..... | 58.304 | ..... | 66.298 | ..... |
| November | 13.576 | ..... | 57.293 | ..... | 65.551 | ..... |
| December | 13.302 | ..... | 56.869 | ..... | 64.114 | ..... |
| Year | 13.795 | ..... | 57.971 | ..... | 65.472 | ..... |

New York quotations, cents per pound. London, pounds sterling per long ton.

### Lead

| | New York | | St. Louis | | London | | | |
|---|---|---|---|---|---|---|---|---|
| | 1926 | 1927 | 1926 | 1927 | 1926 Spot | 1926 3 Mos. | 1927 Spot | 1927 3 Mos. |
| January | 9.255 | 7.577 | 9.102 | 7.392 | 34.778 | 34.584 | 27.485 | 27.786 |
| February | 9.154 | 7.420 | 8.991 | 7.286 | 33.903 | 33.903 | 27.356 | 27.781 |
| March | 8.386 | ..... | 8.165 | ..... | 31.625 | 31.921 | ..... | ..... |
| April | 7.971 | ..... | 7.764 | ..... | 28.775 | 29.284 | ..... | ..... |
| May | 7.751 | ..... | 7.538 | ..... | 28.253 | 28.731 | ..... | ..... |
| June | 8.033 | ..... | 7.876 | ..... | 29.986 | 30.142 | ..... | ..... |
| July | 8.499 | ..... | 8.383 | ..... | 31.716 | 31.545 | ..... | ..... |
| August | 8.908 | ..... | 8.722 | ..... | 32.756 | 32.345 | ..... | ..... |
| September | 8.786 | ..... | 8.515 | ..... | 32.085 | 31.790 | ..... | ..... |
| October | 8.402 | ..... | 8.130 | ..... | 30.821 | 30.696 | ..... | ..... |
| November | 8.005 | ..... | 7.800 | ..... | 29.270 | 29.563 | ..... | ..... |
| December | 7.855 | ..... | 7.688 | ..... | 28.932 | 29.259 | ..... | ..... |
| Year | 8.417 | ..... | 8.223 | ..... | 31.075 | 31.147 | ..... | ..... |

New York and St. Louis quotations, cents per pound. London, pounds sterling per long ton.

### Tin

| | New York | | | | London | |
|---|---|---|---|---|---|---|
| | 1926 99% | 1927 99% | 1926 Straits | 1927 Straits | 1926 Spot | 1927 Spot |
| January | 61.415 | 64.785 | 62.275 | 66.415 | 282.038 | 297.804 |
| February | 62.653 | 66.528 | 63.705 | 69.142 | 287.107 | 306.125 |
| March | 63.472 | ..... | 64.505 | ..... | 292.288 | ..... |
| April | 61.962 | ..... | 63.389 | ..... | 281.388 | ..... |
| May | 60.165 | ..... | 62.305 | ..... | 270.125 | ..... |
| June | 58.409 | ..... | 60.611 | ..... | 268.352 | ..... |
| July | 61.365 | ..... | 63.091 | ..... | 282.102 | ..... |
| August | 63.875 | ..... | 65.260 | ..... | 293.690 | ..... |
| September | 66.535 | ..... | 68.895 | ..... | 306.273 | ..... |
| October | 68.225 | ..... | 70.245 | ..... | 312.548 | ..... |
| November | 68.667 | ..... | 70.630 | ..... | 309.284 | ..... |
| December | 66.635 | ..... | 68.514 | ..... | 306.994 | ..... |
| Year | 63.615 | ..... | 65.285 | ..... | 291.016 | ..... |

New York quotations, cents per pound. London, pounds sterling per long ton.

### Zinc

| | St. Louis | | London | | | |
|---|---|---|---|---|---|---|
| | 1926 | 1927 | 1926 Spot | 1926 3 Mos. | 1927 Spot | 1927 3 Mos. |
| January | 8.304 | 6.661 | 38.059 | 37.363 | 30.979 | 30.938 |
| February | 7.759 | 6.673 | 36.053 | 35.956 | 29.931 | 30.109 |
| March | 7.332 | ..... | 34.090 | 34.247 | ..... | ..... |
| April | 7.001 | ..... | 32.503 | 32.863 | ..... | ..... |
| May | 6.821 | ..... | 32.038 | 32.413 | ..... | ..... |
| June | 7.112 | ..... | 33.244 | 33.398 | ..... | ..... |
| July | 7.411 | ..... | 34.045 | 34.270 | ..... | ..... |
| August | 7.376 | ..... | 34.173 | 34.524 | ..... | ..... |
| September | 7.413 | ..... | 34.389 | 34.415 | ..... | ..... |
| October | 7.296 | ..... | 34.256 | 34.146 | ..... | ..... |
| November | 7.199 | ..... | 33.491 | 33.483 | ..... | ..... |
| December | 7.018 | ..... | 32.915 | 32.895 | ..... | ..... |
| Year | 7.337 | ..... | 34.105 | 34.164 | ..... | ..... |

St. Louis quotations, cents per pound. London, pounds sterling per long ton.

### Antimony, Quicksilver and Platinum

| | Antimony (a) New York | | Quicksilver (b) New York | | Platinum (c) Refined New York | | Platinum (c) Crude New York | |
|---|---|---|---|---|---|---|---|---|
| | 1926 | 1927 | 1926 | 1927 | 1926 | 1927 | 1926 | 1927 |
| Jan. | 23.490 | 13.910 | 87.960 | 101.200 | 118.200 | 109.520 | 113.200 | 99.820 |
| Feb. | 21.676 | 14.509 | 87.580 | 101.727 | 113.909 | 107.545 | 108.341 | 99.295 |
| March | 19.708 | ..... | 88.194 | ..... | 112.000 | ..... | 106.278 | ..... |
| April | 17.462 | ..... | 89.769 | ..... | 111.538 | ..... | 103.731 | ..... |
| May | 12.170 | ..... | 91.365 | ..... | 108.960 | ..... | 102.900 | ..... |
| June | 11.106 | ..... | 91.346 | ..... | 111.000 | ..... | 106.615 | ..... |
| July | 14.490 | ..... | 90.163 | ..... | 114.692 | ..... | 109.000 | ..... |
| Aug. | 15.957 | ..... | 89.260 | ..... | 116.000 | ..... | 108.692 | ..... |
| Sept. | 15.325 | ..... | 91.425 | ..... | 116.840 | ..... | 108.600 | ..... |
| Oct. | 13.943 | ..... | 97.260 | ..... | 112.240 | ..... | 106.000 | ..... |
| Nov. | 13.385 | ..... | 99.000 | ..... | 112.000 | ..... | 105.250 | ..... |
| Dec. | 13.142 | ..... | 99.510 | ..... | 111.846 | ..... | 105.385 | ..... |
| Year | 15.988 | ..... | 91.903 | ..... | 113.269 | ..... | 106.999 | ..... |

(a) Antimony quotations in cents per pound, for ordinary brands. (b) Quick silver in dollars per flask of 75 lb. (c) Platinum in dollars per ounce

### Pig Iron, Pittsburgh

| | Bessemer | | Basic | | No. 2 Foundry | |
|---|---|---|---|---|---|---|
| | 1926 | 1927 | 1926 | 1927 | 1926 | 1927 |
| January | 22.76 | 21.40 | 21.76 | 20.01 | 22.26 | 20.26 |
| February | 22.76 | ..... | 21.76 | ..... | 22.26 | ..... |
| March | 22.76 | ..... | 21.76 | ..... | 22.26 | ..... |
| April | 21.38 | ..... | 20.66 | ..... | 21.05 | ..... |
| May | 21.12 | ..... | 19.76 | ..... | 20.76 | ..... |
| June | 20.76 | ..... | 19.76 | ..... | 19.80 | ..... |
| July | 20.44 | ..... | 19.26 | ..... | 19.49 | ..... |
| August | 19.87 | ..... | 19.18 | ..... | 19.26 | ..... |
| September | 20.11 | ..... | 19.26 | ..... | 19.30 | ..... |
| October | 20.76 | ..... | 19.76 | ..... | 19.97 | ..... |
| November | 21.90 | ..... | 20.46 | ..... | 20.96 | ..... |
| December | 21.26 | ..... | 20.26 | ..... | 20.53 | ..... |
| Year | 21.31 | ..... | 20.29 | ..... | 20.64 | ..... |

In dollars per long ton.

## Monthly Crude Copper Output in Short Tons

### Domestic

| | 1926 August | Sept. | Oct. | Nov. | Dec. | 1927 Jan. |
|---|---|---|---|---|---|---|
| Alaska shipments | 3,093 | 2,078 | 3,073 | 3,769 | 2,372 | 2,981 |
| Braden | 6,289 | 7,040 | 8,000 | 10,200 | ..... | ..... |
| Chile | 9,120 | 9,350 | 9,350 | 9,350 | ..... | ..... |
| Butte & Superior | ..... | 835† | ..... | ..... | ..... | ..... |
| Calumet & Arizona | 1,960 | 1,793 | 2,380 | 1,833 | 1,951 | 1,864 |
| Magma | 1,315 | 1,211 | 1,198 | 1,155 | 1,148 | 1,264 |
| Miami | 2,447 | 2,251 | 2,468 | 2,412 | 2,268 | 2,313 |
| New Cornelia | 3,194 | 3,292 | 3,556 | 4,227 | 3,347 | 2,770 |
| Nevada Con. | ..... | †29,090 | ..... | ..... | ..... | ..... |
| Old Dominion | 1,350 | 797 | 908 | 1,127 | 1,120 | 1,170 |
| Phelps Dodge | 6,723 | 5,866 | 5,493 | 6,638 | 5,732 | 6,097 |
| United Verde Extension | 1,765 | 1,756 | 1,901 | 1,677 | 1,586 | 1,703 |
| Utah Copper | ..... | †30,902 | ..... | ..... | ..... | ..... |
| Tennessee Copper | 511 | 499 | 523 | 524 | 486 | 486 |

### Foreign

| | | | | | | |
|---|---|---|---|---|---|---|
| Boleo, Mexico | 1,124 | 898 | 992 | 992 | ..... | 863 |
| Furukawa, Japan | 1,550 | 1,532 | 1,431 | 1,668 | 1,502 | ..... |
| Granby Cons., Canada | 1,805 | 1,506 | 1,623 | 1,626 | *2,355 | 2,439 |
| Union Miniere, Africa | 8,188 | 7,623 | 6,525 | 7,260 | 7,150 | 6,505 |
| Mount Lyell, Aust. | ..... | †2,182 | ..... | ..... | †1,870 | ..... |
| Sumitomo, Japan | 1,396 | 826 | ..... | 1,637 | ..... | ..... |
| Bwana M'Kubwa | ..... | 195 | 255 | 344 | 376 | ..... |

*Starting with December Allenby production is included. †Three months.

## Monthly Production of Primary Copper from U. S. Mines and Daily Rate (Short Tons)

| | 1925 Monthly Production | 1925 Daily Rate | 1926 Monthly Production | 1926 Daily Rate | 1927 Monthly Production | 1927 Daily Rate |
|---|---|---|---|---|---|---|
| January | 74,789 | 2,412 | 71,026 | 2,291 | 76,684 | 2,473 |
| February | 68,967 | 2,463 | 68,131 | 2,433 | ..... | ..... |
| March | 74,901 | 2,415 | 75,728 | 2,443 | ..... | ..... |
| April | 70,667 | 2,356 | 73,454 | 2,448 | ..... | ..... |
| May | 70,574 | 2,276 | 73,542 | 2,372 | ..... | ..... |
| June | 59,894 | 2,330 | 71,317 | 2,377 | ..... | ..... |
| July | 68,507 | 2,210 | 72,278 | 2,330 | ..... | ..... |
| August | 68,090 | 2,196 | 72,014 | 2,323 | ..... | ..... |
| September | 67,720 | 2,272 | 72,672 | 2,421 | ..... | ..... |
| October | 71,042 | 2,292 | 75,099 | 2,423 | ..... | ..... |
| November | 67,400 | 2,247 | 74,947 | 2,498 | ..... | ..... |
| December | 69,566 | 2,244 | 72,205 | 2,329 | ..... | ..... |
| Total | 842,117 | ..... | 872,509 | ..... | ..... | ..... |
| Monthly average | 70,176 | ..... | 72,709 | ..... | ..... | ..... |
| Average of daily rate | ..... | 2,307 | ..... | 2,390 | ..... | ..... |

# Freight Rates on Metals, Ores, and Concentrates

**Carload Lots**

## Copper Bullion and Refined Copper

| From | To | Rate per Ton of 2,000 Lb. All Rail | Via Gulf |
|---|---|---|---|
| El Paso, Tex. | Baltimore, Md. | $11.40 | $9.40 |
| Garfield, Utah | Perth Amboy | 12.50 | ..... |
| Garfield, Utah | San Francisco | 5.85 | ..... |
| Hayden, Ariz. | Perth Amboy | 14.50 | 12.50 |
| Miami, Ariz. | Perth Amboy | 14.50 | 12.50 |
| Anaconda, Mont. | Perth Amboy | 12.50 | ..... |
| Butte, Mont. | Perth Amboy | 12.50 | ..... |
| Humboldt, Ariz. | Chrome, N. J. | 14.50 | 12.50 |
| Douglas, Ariz. | Perth Amboy | 14.50 | 12.50 |
| Globe, Ariz. | Perth Amboy | 14.50 | 12.50 |
| Clifton, Ariz. | Perth Amboy | 14.50 | 12.50 |
| Clarkdale, Ariz. | Chrome, N. J. | 14.50 | 12.50 |
| Copperhill, Tenn. | Laurel Hill, N. Y. | $10.80 | ..... |
| Tooele, Utah | Chrome, N. J. | 12.50 | ..... |
| McGill, Nev. | Baltimore, Md. | 12.90 | ..... |
| Houghton, Mich. | New York | 9.60 | ..... |
| Hancock, Mich. | New York | 9.60 | ..... |
| Hubbell, Mich. | New York | 9.60 | ..... |
| Dollar Bay, Mich. | New York | 9.60 | ..... |
| Anaconda, Mont. | Tacoma, Wash. | 7.09 | ..... |
| Ajo, Ariz. | New York | 14.50 | $12.50 |

## Marine Conference Freight Rates

| | | |
|---|---|---|
| New York to | | |
| Hamburg | $6.50 | per gross ton copper and lead |
| Liverpool | 6.50 | per gross ton copper and lead |
| Antwerp | 6.00 | per gross ton copper and lead |
| Havre | 5.50 | per gross ton lead |
| | 5.75 | per gross ton copper |
| Gulf ports to | | |
| Hamburg | $5.00 | per gross ton copper, lead and zinc |
| Liverpool | 5.50 | per gross ton copper, lead and zinc |
| Antwerp | 4.50 | per gross ton copper, lead and zinc |
| Havre | 5.25 | per gross ton copper, lead and zinc |
| Pacific coast ports to | | |
| Hongkong | $5.00 | per short ton copper and lead |
| Kobe | 5.00 | per short ton copper and lead |

## Lead Bullion (Pig Lead Where Shown)

| From | Rates per Ton of 2,000 Lb. To New York | | To St. Louis |
|---|---|---|---|
| East St. Louis, Ill. | $7.00 | | ..... |
| Pueblo, Colo. | 12.50 | | $9.00 |
| Leadville, Colo. | 12.50 | | 9.00 |
| East Helena, Mont | 12.50 | | 9.50 |
| El Paso, Tex. | 10.00 | Via Gulf | |
| | 12.00 | All Rail | 7.00 |
| Omaha, Neb. | 9.60 | | 3.65 |
| Murray, Utah | 12.50 | | 9.00 |
| Midvale, Utah | 12.50 | | 9.00 |
| Tooele, Utah | 12.50 | | 9.00 |
| East Chicago, Ill. | 6.40 | | (a) 1.60 |
| Kellogg, Idaho | 13.50 | | 9.50 |
| Carnegie, Pa. | 3.80 | | (a) 5.00 |
| Selby, Calif. | (b) 6.00 | | ..... |
| Herculaneum, Mo. | (a) 8.80 | | (a) 1.80 |
| Federal, Ill. | 7.00 | | (a) 1.80 |
| Collinsville, Ill. | 7.00 | | (a) .75½ |
| Granby, Mo. | (a) 10.50 | | (a) 3.50 |
| Joplin, Mo. | (a) 10.50 | | (a) 3.50 |

(a) Pig lead only.
(b) Conference rate, via canal.

## Slab Zinc

| From | Rates per Net Ton to E. St. Louis | New York |
|---|---|---|
| Donora, Pa. | (a) $4.60 | $3.80 |
| Langeloth, Pa. | (a) 4.60 | 3.80 |
| Palmerton, Pa. | 7.10 | 3.00 |
| Hillsboro, Ill. | 1.40 | 7.00 |
| Danville, Ill. | 1.60 | 6.40 |
| La Salle, Ill. | 1.60 | 6.70 |
| Springfield, Ill. | 3.00 | 7.00 |
| Cleveland, Ohio | 5.80 | 5.00 |
| Moundsville, W. Va. | 4.40 | 3.80 |
| Van Buren, Ark. | 3.80 | 10.80 |
| Fort Smith, Ark. | 3.80 | 10.80 |
| Bartlesville, Okla. | 3.50 | 10.50 |
| Blackwell, Okla. | 3.80 | 10.80 |
| Henryetta, Okla. | 3.80 | 10.80 |
| Sand Springs, Okla. | 3.80 | 10.80 |
| Cherryvale, Kan. | 3.50 | 10.50 |
| Black Eagle, Mont. | 9.40 | 12.50 |
| Park City, Utah | 9.00 | 12.50 |
| Amarillo, Tex. | 5.80 | 12.80 |

(a) To St. Louis, Mo.

## Zinc Ores and Concentrates

| To | From | Rate per Net Ton |
|---|---|---|
| Bartlesville, Okla. | Altoona, Kan. | $2.10 |
| | Pittsburg, Kan. | 1.09 |
| | Galena, Kan. | 1.30 |
| | Joplin, Mo. | 1.40 |
| | Iola, Kan. | 1.09 |
| | Baxter, Kan. | 1.50 |
| | Miami, Okla. | 1.40 |
| | Quapaw, Okla. | 1.40 |
| | Kansas City, Mo. | 1.60 |
| Sand Springs, Okla. | Miami, Okla. | 2.20 |
| | Quapaw, Okla. | 2.20 |
| | Galena, Kan. | 1.50 |
| | Joplin, Mo. | 1.50 |
| | Iola, Kan. | 2.40 |
| Dewar, Okla. | Cave Springs, Mo. | 2.00 |
| Kusa, Okla. | Cent City Spur, Mo. | 2.00 |
| Henryetta, Okla. | Chitwood, Mo. | 2.00 |
| | Galena, Kan. | 1.50 |
| La Harpe, Kan. | Mound City, Kan. | .50 |
| | Oawego, Kan. | .50 |
| | Parsons, Kan. | .50 |
| Coffeyville, Kan. | Galena, Kan. | 1.10 |
| | Joplin, Mo. | 1.22 |
| Bartlesville, Okla. (a) | Baxter, Kan. | 1.80 |
| | Miami, Okla. | 1.80 |
| | Quapaw, Okla. | 1.80 |

(a) Lead ore and concentrates.

## Rates on Ores and Concentrates

| From | To | Value of Product $5 | $10 | $15 | $20 | $25 | $30 | $35 | $40 | $50 | $60 | $70 | $75 | $80 | $90 | $100 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | Rate | | | | | | | | | | | | | | |
| Butte, Mont. | Anaconda, Mont. | .22 | .22 | .22 | .22 | .22 | .22 | .22 | .22 | .22 | .22 | .22 | 22 | .22 | .22 | 22 |
| Butte, Mont. | Black Eagle, Mont. (a) | .... | .... | .... | .... | .... | .... | .... | 1.01 | .... | .... | .... | .... | .... | .... | 1 01 |
| Great Falls, Mont. | Helena, Mont. | .... | .... | 1.50 | .... | 1.69 | .... | 1.91 | .... | 2.36 | .... | .... | .... | .... | .... | 2 48 |
| Butte, Mont. | East Helena, Mont. | .... | .... | 1.17 | .... | 1.46 | .... | 1.69 | .... | 2 03 | .... | .... | .... | .... | .... | 2 14 |
| Paxton, Calif. | Salt Lake Smelters, Utah | .... | .... | .... | .... | .... | .... | .... | .... | 5 50 | 6 00 | 6 70 | .... | 7.40 | 8 10 | 8 80 |
| Johannesburg, Calif. | Selby, Calif. | .... | .... | .... | 2.90 | .... | 3.50 | .... | 4.10 | 4.70 | 5.30 | 5.90 | .... | 6.50 | 6 80 | 7 10 |
| Johannesburg, Calif. | Humboldt, Ariz. | .... | .... | .... | 3.40 | .... | 4.10 | .... | 4.80 | 5.50 | 6 20 | 6.90 | .... | 7.60 | 8 00 | 8 30 |
| Pioche, Nev. | Humboldt, Ariz. | .... | .... | 7.74 | .... | 8.55 | .... | 9.36 | .... | 9.99 | .... | .... | 11.25 | .... | .... | 12 42 |
| Creede, Colo. | Durango, Colo. | .... | .... | 3.25 | 3.50 | 3.75 | 4.00 | .... | 4.25 | 4.75 | 5.25 | 5.75 | 6.05 | .... | .... | 7 10 |
| Ouray, Colo. | Durango, Colo. | .... | .... | 4.30 | 4.80 | .... | 5.05 | .... | 5 50 | 5 90 | .... | 6.30 | .... | .... | .... | 7 70 |
| Telluride, Colo. | Durango, Colo. | .... | .... | .... | 4.00 | .... | 4.30 | .... | 4.60 | 5 10 | 5.60 | 6 1 | .... | 6.50 | 7.00 | 7 50 |
| Silverton, Colo. | Durango, Colo. | .... | .... | 1.40 | 1.40 | .... | .... | 2.20 | .... | .... | .... | .... | .... | 2 30 | 2.55 | 2 80 |
| Tyrone, N. M. | Douglas, Ariz. | .... | .... | 1.60 | 2 30 | .... | 2.60 | .... | 2.90 | 3 20 | .... | .... | 3 80 | .... | .... | 4 40 |
| Tyrone, N. M. | El Paso, Tex. | .... | .... | 1.40 | 1 70 | .... | 2.00 | .... | 2 30 | 2 60 | .... | .... | 3 20 | .... | .... | 3 80 |
| Lordsburg, N. M. | Douglas, Ariz. | .... | 1.00 | 1.30 | 1 70 | .... | 2.00 | .... | 2.30 | 2 60 | .... | .... | 3 20 | .... | .... | 3 80 |
| Lordsburg, N. M. | El Paso, Tex. | .... | 1.00 | 1.30 | 1.80 | .... | 2.10 | .... | 2 40 | 2.70 | .... | .... | 3 30 | .... | .... | 3 90 |
| Tombstone, Ariz. | Douglas, Ariz. | .... | .... | .60 | 1 30 | .90 | 1 60 | .... | 1.90 | 2 20 | .... | .... | 2.80 | .... | .... | 3 40 |
| Tombstone, Ariz. | El Paso, Tex. | .... | 1.60 | 1.90 | .... | 2.50 | .... | .... | 3.50 | 3.80 | .... | .... | 4.40 | .... | .... | 5 00 |
| Ray Junction, Ariz. | Hayden, Ariz. | .... | .10 | .... | .40 | .... | .50 | .... | .80 | .90 | .... | .... | 1.00 | .... | .... | 1 10 |
| Sandon, B. C. / Alamo Concentrator, B. C. | Tadanac, B. C. | 1.50 | 1.60 | 1.70 | 1.90 | 2.00 | 2.50 | .... | 2.60 | 2.90 | 3.40 | 3.50 | .... | 3.70 | 3.80 | 3.90 |
| Rossland, B. C. | Tadanac, B. C. | .90 | .90 | 1.00 | 1.00 | 1.10 | 1.50 | .... | 1.60 | 1 60 | 1.60 | 1.70 | .... | 1.70 | 1.70 | 1.70 |
| Rossland, B. C. | Tadanac, B. C (d) | .30 | .30 | .30 | .30 | .50 | .70 | .... | .80 | .80 | .... | .... | .... | .... | .... | .... |
| Republic, Wash. | Tadanac, B. C. | .... | 2.11 | 2.56 | 2.66 | 2.86 | 3.84 | .... | 3.84 | 3 84 | 4.69 | 4.89 | .... | 5.19 | 5.39 | 5.59 |

(a) Minimum tonnage of 200 tons per day. (b) In open cars, minimum 80,000 lb. (c) Plus $2.70 per car switching.
(d) Applicable on ore only when shipped in trainload lots of not less than 10 cars and exclusive of switching charges at Rossland.

| From | To | Value of Ores and Concentrates $10 | $15 | $20 | $25 | $30 | $35 | $40 | $50 | $60 | $70 | $75 | $80 | $90 | $100 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | Rate | | | | | | | | | | | | | |
| Burke, Idaho (a) (d) | Bradley, Idaho | .... | .... | .... | .... | .... | .... | .... | .... | .68 | .... | .... | .... | .... | 1 02 |
| Burke and Wallace, Idaho | East Helena, Mont. | .... | .... | .... | .... | 3.00 | .... | 3.25 | 3 50 | 3.75 | 4.00 | .... | 4.25 | 4.50 | 4 75 |
| Sagel, Idaho | East Helena, Mont. | .... | .... | .... | 3.38 | .... | 3.83 | .... | 4.16 | .... | .... | .... | .... | .... | 4.84 |
| Arizona Tunnel, Idaho | Bradley, Idaho | .... | .... | .... | .... | .... | .... | .... | .... | .35 | .... | .... | .... | .... | .50 |
| Bayview, Idaho | Bradley, Idaho | .... | .... | .... | .... | .... | .... | .... | 3.75 | .... | .... | 4.37½ | .... | .... | 5 12 |
| Park City, Utah | Salt Lake Smelters | 1.00(c) | 1.10 | 1 25 | .... | 1.50 | .... | 1.75 | .... | 2 00 | .... | .... | 2.25 | .... | 2 50 |
| Eureka, Utah | Salt Lake Smelters | 1 00 | 1 10 | 1 25 | .... | 1.50 | .... | 1.75 | 2.00 | 2 25 | 2 50 | .... | 2.75 | 3 00 | 3 25 |
| Tintic, Utah | Salt Lake Smelters | 1 00 | 1 10 | 1 25 | .... | 1.50 | .... | 1.75 | 2.00 | 2 25 | 2.50 | .... | 2.75 | 3 00 | 3 25 |
| St. Johns, Utah | Salt Lake Smelters | 1 00 | 1.10 | 1 25 | .... | 1.50 | .... | 1.75 | 2.00 | 2 25 | 2 50 | .... | 2.75 | 3 00 | 3 25 |
| Ophir, Utah | Salt Lake Smelters | 1.00 | .... | 1 25 | .... | 1.50 | .... | 1.75 | 2.00 | 2.25 | 2.50 | .... | 2.75 | 3.00 | 3 25 |
| Bingham, Utah | Garfield, Utah | .... | .40 | .... | .75 | .... | .... | .... | .95 | .... | .... | 1.10 | .... | .... | 1 25 |
| Cherry Creek, Nev. | Garfield, Utah (c) | .... | .... | 4 60 | .... | 5 10 | .... | 5.60 | 6 10 | 6 60 | 7.10 | .... | 7 60 | 8.10 | 8 60 |
| Cherry Creek, Nev. | Garfield, Utah (b) | .... | .... | 3.20 | .... | 3 90 | .... | 4.60 | 5 30 | 6 00 | 6.70 | .... | 7 40 | .... | .... |
| Goldfield, Nev. | Salt Lake Smelters | .... | 4 15 | 5 10 | .... | 5 80 | .... | 6.50 | 7.20 | 7.90 | 8.60 | .... | 9.30 | 10.00 | 10 70 |
| Battle Mountain (a) | Salt Lake Smelters | .... | .... | 3.20 | .... | 3.80 | .... | 4.40 | 5.00 | 5.60 | 6.20 | .... | 6.80 | 7.40 | 8.00 |
| Palisade, Nev. (a) | Salt Lake Smelters | 2.20 | 2.90 | 3 20 | .... | 3 80 | .... | 4.30 | 4.80 | 5.30 | 5.80 | .... | 6.30 | 6.80 | 7 30 |
| Mina, Nev. (a) | Salt Lake Smelters | .... | .... | 3 60 | .... | 4 30 | .... | 5.00 | 5.70 | 6.40 | 7.10 | .... | 7.80 | 8 50 | 9 20 |
| Lovelock, Nev. (a) | Salt Lake Smelters | .... | .... | 3.20 | .... | 3.90 | .... | 4.60 | 5 30 | 6.00 | 6.70 | .... | 7.40 | 8 10 | 8 80 |
| Golconda, Nev. (a) | Salt Lake Smelters | .... | .... | 3.20 | .... | 3.90 | .... | 4.60 | 5.30 | 6.00 | 6.70 | .... | 7.40 | 8 10 | 8 80 |
| Hazen, Nev. (a) | Salt Lake Smelters | .... | .... | 3.20 | .... | 3.90 | .... | 4.60 | 5.30 | 6.00 | 6.70 | .... | 7.40 | 8 10 | 8 80 |
| Tonopah, Nev. | Salt Lake Smelters | .... | 4 15 | 5 10 | .... | 5.80 | .... | 6 50 | 7.20 | 7 90 | 8 60 | .... | 9.30 | 10.00 | 10 00 |
| Rogerson, Idaho | Salt Lake Smelters | 2.50 | 2 75 | 3.50 | .... | 4.00 | .... | 4.50 | 5.00 | 5 50 | 6 00 | .... | 6.50 | 7 00 | 7 07 |
| Georgetown, Colo. | Leadville, Colo | .... | .... | 3.50 | .... | 3 75 | .... | 4 00 | 5.00 | 5.00 | 5 80 | .... | 5.80 | 5 80 | 5 85 |

(a) Minimum weight, marked capacity of car used, but not less than 80,000 lb. (b) Minimum weight, 80,000 lb. (c) Minimum weight, 40,000 lb.
(d) Crude ore for concentration, 30c. per ton.
(e) For $9 value rate is 95c.; $8 values, 90c.; $7 value, 85c.; $6 value, 80c.

# Mining Stocks—Week Ended February 26, 1927

| Stock | Exch. | High | Low | Last | | Last Div. |
|---|---|---|---|---|---|---|
| **COPPER** | | | | | | |
| Anaconda | New York | 49⅜ | 46½ | 47⅜ | Ja. 15, Fe. 21 | Q 0.75 |
| Arcadian Consol. | Boston | ... | ... | *50 | ... | ... |
| Ariz. Com'l | Boston | 9 | 7⅞ | 8⅞ | Ja. 7, Ja. 28 | 0.50 |
| Calaveras | N. Y. Curb | 1¼ | 1¼ | 1¼ | ... | ... |
| Calumet & Arizona | New York | 69 | 66¾ | 68 | Ma. 5, Ma. 21 | Q 1.50 |
| Calumet & Hecla | Boston | 16 | 15¾ | 15¾ | Fe.28, Ma.15 | Q 0.50 |
| Cerro de Pasco | New York | 63½ | 60⅞ | 61⅛ | Ja.13, Fe.1, | Q 1.00 |
| Chile Copper | New York | 36⅝ | 35⅛ | 36 | Ma.4, Apr.1, | Q 0.62½ |
| Chino | New York | ... | ... | 22⅜ | ... | ... |
| Con. Coppermines | N. Y. Curb | 2⅞ | 2⅝ | 2⅝ | ... | ... |
| Copper Range | Boston | 14 | 13 | 13½ | May, 1926 | 1.00 |
| Crystal Copper | Boston Curb | *25 | *25 | *25 | ... | ... |
| East Butte | Boston | 2⅝ | 2¼ | 2½ | Dec., 1919 | 0.50 |
| First National | Boston Curb | ... | ... | *9 | Feb., 1919 | 0.15 |
| Franklin | Boston | ... | ... | *10 | ... | ... |
| Granby Consol. | New York | 38¼ | 34 | 37¾ | May, 1919 | 1.25 |
| Greene-Cananea | New York | 33 | 31⅞ | 32¾ | Nov., 1920 | 0.50 |
| Hancock | Boston | *40 | *40 | *40 | ... | ... |
| Howe Sound | New York | 40 | 38½ | 39½ | De.31, Ja.15 | Q 1.00 |
| Inspiration Consl. | New York | 24⅜ | 21⅞ | 22 | Ma.17, Ap.4, | Q 0.25 |
| Iron Cap | Boston Curb | 1⅞ | 1⅜ | 1⅜ | ... | ... |
| Isle Royale | Boston | 10⅛ | 9½ | 10 | Fe.4, Fe.19 | Q 0.50 |
| Jerome Verde Dev. | N. Y. Curb | ... | ... | *41 | ... | ... |
| Kennecott | New York | 64½ | 62 | 63⅞ | Mar. 4 Apr. 1 | Q 1.25 |
| Lake Copper | Boston | ... | ... | 1 | June, 1925 | 0.50 |
| Magma Copper | New York | 35⅛ | 33⅞ | 35⅛ | Dec. 1, Ja. 15, | Q 0.75 |
| Mason Valley | N. Y. Curb | 1⅞ | 1⅝ | 1⅝ | ... | ... |
| Mass Consolidated | Boston | ... | ... | *35 | Nov., 1917 | 1.00 |
| Miami Copper | New York | 16⅛ | 15⅝ | 16 | Fe.1, Fe. 15 | Q 0.37½ |
| Mohawk | Boston | 40 | 37 | 39½ | Ja.29, Ma.1 | Q 1.00 |
| Mother Lode Coa. | New York | 4¼ | 4⅛ | 4⅛ | De.10, De.31 | SA 0.37½ |
| Nevada Consol. | New York | 15 | 14⅛ | 14⅞ | De.15, De.31 | Q 0.37½ |
| New Cornelia | Boston | 22⅞ | 22½ | 22½ | Fe.4, Fe.21 | Q 0.50 |
| Noranda | N. Y. Curb | 22¼ | 20½ | 22½ | ... | ... |
| North Butte | Boston | 2⅜ | 2⅛ | 2⅛ | Oct., 1918 | 0.25 |
| Ohio Copper | N. Y. Curb | *44 | *44 | *44 | Se. 1, Se. 15 | 0.03 |
| Old Dominion | Boston | 13½ | 12½ | 13½ | Dec., 1918 | 1.00 |
| Phelps Dodge | Open Mar. | †127 | †124 | ... | De.24, Ja.3 | Q 1.50 |
| Quincy | Boston | 16 | 15 | 16 | Mar., 1926 | 1.00 |
| Ray Consolidated | New York | 15⅞ | 14⅜ | 15⅜ | Ap.20, Ap.30 | 0.25 |
| St. Mary's Min. Ld. | Boston | 24 | 20½ | 24 | Fe.10 Ma.10 | 2.00 |
| Seneca Copper | New York | 3 | 3 | 3 | ... | ... |
| Shannon | Boston | *40 | *40 | *40 | Nov., 1917 | 0.25 |
| Shattuck-Denn | Boston Curb | 6 | 5¼ | 5¼ | ... | ... |
| Superior & Boston | Curb | *40 | *30 | *40 | ... | ... |
| Tenn. C. & C. | New York | 12⅞ | 12 | 12½ | Fe.28, Ma.15, | Q 0.25 |
| United Verde Ex. | N. Y. Curb | 28 | 23½ | 27¾ | Ja. 6, Fe. 1 | 0.75 |
| Utah Copper | New York | 111 | 111 | 111 | De.15, De.31 | Q 1.50 |
| Utah Metal & T. | Boston | 1⅛ | 1⅛ | 1⅛ | Dec., 1917 | 0.30 |
| Victoria | Boston | ... | ... | *75 | ... | ... |
| Walker Mining | Salt Lake | *80 | *76 | *80 | ... | ... |
| **NICKEL-COPPER** | | | | | | |
| Internat. Nickel | New York | 44 | 42½ | 42⅝ | De.16, De.31, | Q 0.50 |
| Internat. Nickel, pfd. | New York | 104 | 104 | 104 | Ja. 13, Fe. 1, | Q 1.50 |
| **LEAD** | | | | | | |
| Gladstone Mtn. | Spokane | *29 | *29 | *29 | Fe. 1927 | 0.005 |
| National Lead | New York | 178½ | 172½ | 176 | Ma.11, Ma.31 | Q 2.00 |
| National Lead pfd. | New York | 118 | 118 | 118 | No.19, De.15 | Q 1.75 |
| St. Joseph Lead | New York | 41⅝ | 41 | 41⅝ | Jn.10, Jn.20, | QX 0.75 |
| **ZINC** | | | | | | |
| Am. Z. L. & S. | New York | 10⅛ | 9⅜ | 10 | May, 1917 | 1.00 |
| Am. Z. L. & S, pfd. | New York | 50⅛ | 49⅜ | 50⅛ | Nov., 1920 | 1.50 |
| Butte C. & Z. | New York | 4⅛ | 4 | 4 | De.9, De.24 | 0.50 |
| Butte & Superior | New York | 11⅜ | 10⅛ | 11⅜ | Ma.15, Ma.31 | Q 0.50 |
| Callahan Zn-Ld | New York | 2⅛ | 2 | 2 | Dec., 1920 | 0.50 |
| Eagle-Picher | Cincinnati | 26⅛ | 26¼ | 26⅜ | Fe.15, Ma.1 | Q 0.40 |
| Eagle-Picher, pfd. | Cincinnati | ... | ... | 100 | De.31, Ja.15 | Q 1.50 |
| New Jersey Zn. | N. Y. Curb | 187 | 186¼ | 186¼ | Ja.20, Fe.10 | Q 2.00 |
| United Zinc | N. Y. Curb | ... | ... | 55 | ... | ... |
| Yellow Pine | Los Angeles | *27 | *25 | *25 | Dec. 1925 | Q 0.04 |
| **GOLD** | | | | | | |
| Alaska Juneau | New York | 2⅛ | 2 | 2 | ... | ... |
| Argonaut | Toronto | *41 | *34 | *36 | ... | ... |
| Barry-Hollinger | Toronto | *62 | *46 | *49 | ... | ... |
| Carson Hill | Boston | *20 | *11 | *11 | ... | ... |
| Consol. W. Dome L. | Toronto | *16 | *13½ | *15½ | ... | ... |
| Cresson Consol. G. | N. Y. Curb | ... | ... | 2⅛ | De.31, Ja.10 | Q 0.10 |
| Crown Reserve | Toronto | *9⅜ | *9 | *9 | Jan., 1917 | 0.05 |
| Dome Mines | New York | 9¼ | 8⅜ | 8⅜ | De.31, Ja.30, | Q 0.50 |
| Golden Center | N. Y. Curb | 1½ | 1⅜ | 1½ | ... | ... |
| Golden Cycle | N. Y. Curb | ... | ... | 1⅜ | No.30, De.10 | Q 0.04 |
| Hollinger Consol. | Toronto | 22.30 | 22.00 | 22.15 | Fe.9, Fe.25 | 0.10 |
| Homestake Mining | New York | 60½ | 60 | 60½ | Fe.19, Fe.25 | MO.50 |
| Kirkland Lake | Toronto | *88 | *85 | *87 | ... | ... |
| Lake Shore | Toronto | 18.50 | 17.60 | 18.50 | Ma.1, Ma.15 | 0.10 |
| McIntyre-Porcupine | New York | 27 | 26⅜ | 27 | Fe.1, Ma.1 | Q 0.25 |
| Newray | Toronto | *31½ | *31½ | *31½ | ... | ... |
| Night Hawk Pen. | Toronto | *5 | *4⅜ | *5 | ... | ... |
| Portland | Colo Springs | †*56 | †*55 | ... | Ja.6, Ja.15, '27 | 0.02 |
| Rand Mines | New York | ... | ... | 9⅛ | Au.23-30 | Am.Sh. 1.52 |
| Teck-Hughes | Toronto | 6.76 | 6.20 | 6.75 | Ja.31, Fe. 1 | 0.05 |
| Tom Reed | Los Angeles | *52½ | *50 | *50 | Dec., 1926 | 0.02 |
| Tough-Oakes | Toronto | *57 | *53 | *55 | ... | ... |
| United Eastern | N. Y. Curb | *50 | *45 | *45 | July, 1924 | 0.05 |
| Vipond Cons. | Toronto | 1.61 | 1.43 | 1.44 | Apr. 1 Apr. 15 | 0.03 |
| Wright-Hargreaves | Toronto | 11.00 | 10.15 | 10.75 | Ja15, Fe.1 | QX 0.15 |
| Yukon-Alaska Trust | N. Y. Curb | .... | .... | 20 | ... | ... |
| **GOLD AND SILVER** | | | | | | |
| Carnegie Metals | Pittsburgh | 12⅛ | 12⅛ | 12⅜ | ... | ... |
| Con. Cortes | N. Y. Curb | *30 | *15 | *18 | ... | ... |
| Con. Virginia | San Francisco | *4⅜ | *3⅜ | *4⅜ | ... | ... |
| Continental Mines | N. Y. Curb | .... | .... | *4 | ... | ... |
| Dolores Esperanza | N. Y. Curb | .... | .... | 40 | July, 1923 | 0.05 |
| Premier Gold | N. Y. Curb | .... | .... | 2⅛ | Ma.15, Ap.4 | Q 0.08 |
| Tonopah Belmont | N. Y. Curb | 1⅝ | 1⅝ | 1⅝ | Se.15, Oc.1 | 0.05 |
| Tonopah Extension | N. Y. Curb | .... | .... | 1⅝ | Apr. 1925 | 0.05 |
| Tonopah Mining | N. Y. Curb | 3 | 3 | 3 | Ma.31, Apr.21 | 0.07½ |
| West End Consol. | N. Y. Curb | *11 | *10 | *11 | Mar., 1923 | 0.05 |
| Yukon Gold | N. Y. Curb | *45 | *45 | *45 | June, 1918 | 0.02 |

| Stock | Exch. | High | Low | Last | | Last Div. |
|---|---|---|---|---|---|---|
| **SILVER** | | | | | | |
| Beaver Consol | Toronto | *66 | *63 | *66 | May. 1926 | 0.03 |
| Canadian Lorrain | Toronto | *57 | 50½ | *50½ | ... | ... |
| Castle-Trethewey | Toronto | 1.09 | 1.06 | 1.06 | ... | ... |
| Comagas | Toronto | 3.90 | 3.80 | 3.80 | May, 1924 | 0.12½ |
| Keeley | Toronto | 1.63 | 1.46 | 1.46 | Fe.28, Ma. | X 0.12 |
| Kerr Lake | N. Y. Curb | *90 | *85 | *85 | Oc.1, Oc.15 | SA 0.12½ |
| La Rose | Toronto | *10 | *8 | *10 | Apr., 1922 | 0.10½ |
| Lorrain Trout Lake | Toronto | ... | ... | *30 | July, 1925 | 0.05 |
| McKinley-Dar.-Sav. | Toronto | *17½ | *15½ | *16½ | Oct., 1920 | 0.03 |
| Mining Corp. Can. | Toronto | 3.30 | 3.20 | 3.20 | De.30, Ja.15 | 0.12½ |
| Nipissing | N. Y. Curb | 9⅜ | 9⅛ | 9⅛ | De.31, Ja.20 | Q 0.15 |
| Temiskaming | Toronto | .... | .... | *10 | Jan., 1920 | 0.40 |
| **SILVER-LEAD** | | | | | | |
| Ahumada | New York | 4⅜ | 4⅛ | 4⅜ | De.18, Ja.5, | QX 0.15 |
| Bingham Mines | Boston | 44⅝ | 42½ | 44¼ | De.30, Ja.5 | Q 1.00 |
| Cardiff M. & M. | Salt Lake | *42 | *40 | *40 | Feb. 5, 1927 | 0.10 |
| Chief Consol. | Salt Lake | 2.87½ | 2.85 | 2.85 | Oc.10, No.1 | Q 0.10 |
| Consti'n Mng. & Mill'g | Spokane | *30 | *27 | *30 | ... | ... |
| Erupcion | Boston Curb | *75 | *60 | *60 | De.18 Ja.3 | Q 0.10 |
| Eureka Lily | Salt Lake | 1.62½ | 1.35 | 1.40 | ... | ... |
| Federal M. & S. | New York | 83 | 80½ | 80½ | ... | ... |
| Federal M. & S., pfd. | New York | 78½ | 77½ | 78 | Fe.24, Ma.15 | Q 1.75 |
| Hawthorne Mines | N. Y. Curb | *6 | *5 | *6 | ... | ... |
| Hecla Mining | N. Y. Curb | 13½ | 13⅛ | 13¼ | Fe.15, Ma.15 | Q 0.25 |
| Highland-Surprise | Spokane | *14½ | *13 | *13 | ... | ... |
| Iron King Mining | Salt Lake | *32 | *25 | *32 | ... | ... |
| Keystone Mining | Salt Lake | *38 | *39 | *39 | Au.12, Au.26 | 0.07½ |
| Lucky Jim | Spokane | *15½ | *15 | *15¼ | ... | ... |
| Lucky Tiger-Com. | Kansas City | †7.25 | †6 87½ | .... | Ja., 1927 | M 0.05 |
| Mammoth Mining | Salt Lake | 2.50 | 2.50 | 2.50 | De.17, De.23, | Q 0.25 |
| Marsh Mines | Spokane | 2.37½ | 2.25 | 2.37½ | ... | ... |
| North Lily | Salt Lake | 3.40 | 2.60 | 3.40 | ... | ... |
| Park Utah | New York | 7⅜ | 7⅛ | 7⅜ | De.15, Ja.2 | Q 0.15 |
| Plutus Mining | Salt Lake | 1.85 | 1.85 | 1.85 | Ja.10, Ja.15 | Q 0.10 |
| San Rafael | San Francisco | *30 | *30 | *30 | ... | ... |
| Silver King Coal | Salt Lake | 8.00 | 7.75 | 7.75 | De. 16, Ja.3 | 0.25 |
| Silversmith | Spokane | *32½ | *31 | *31½ | Oc.1, Oc.10 | Q 0.02 |
| Strattons Mines | Spokane | *42½ | *40 | *42 | ... | ... |
| Sunshine M. Co. | Spokane | *47⅞ | *45 | *47½ | ... | ... |
| Tamarack-Custer | Spokane | *36½ | *27½ | *28 | Sept., 1924 | 0.25 |
| Tintic Standard | Salt Lake | 11.37½ | 11.00 | 11.00 | De.11, Ja.3 | 0.30 |
| Utah-Apex | Boston | 7⅞ | 6⅞ | 7⅛ | Oc.3, Oc.15 | Q 0.25 |
| **IRON** | | | | | | |
| Bethlehem Steel | New York | 49⅜ | 46½ | 49½ | July, 1924 | 1.25 |
| Cleveland-Cliffs Iron | Cleveland | 80 | 74 | 75 | Ja.15, Ja.25 | Q 1.00 |
| Colorado Fuel & Iron | New York | 60⅜ | 56⅜ | 58⅛ | May, 1921 | 0.75 |
| Gt. North'n Iron Ore | New York | 22⅛ | 21⅛ | 21⅛ | Dec.6, Dec.28 | 0.75 |
| Inland Steel | New York | 43 | 42 | 42⅜ | Fe 15, Ma.1 | Q 0.62½ |
| Mesabi Iron | N. Y. Curb | ... | ... | *95 | ... | ... |
| Replogle Steel | New York | 12 | 11⅞ | 11⅞ | ... | ... |
| Republic I. & S. | New York | 68⅛ | 63½ | 68⅛ | Fe.15 Ma. 1 | Q 1.0 |
| Republic I. & S. pfd. | New York | 102⅛ | 101⅛ | 102⅛ | Ma.15, Ap.1 | Q 1.75 |
| Sloss-Sheffield S. & I. | New York | 132⅛ | 129⅛ | 130⅛ | Ma 10, Ma.21 | Q 1.50 |
| Sloss-Shef. S.&I. pfd. | New York | ... | ... | 108 | Ma 21, Ap.1 | Q 1.75 |
| U. S. Steel | New York | 162⅞ | 157⅛ | 160⅞ | Fe.28, Ma.30 | Q 1.75 |
| U. S. Steel pfd | New York | 130 | 129 | 130 | Ja.29, Fe.26, | Q 1.75 |
| Virginia I. C. & C. | New York | ... | ... | 44 | Jan., 1924 | 1.500 |
| Virginia I.C.&C.pfd | New York | ... | ... | 60⅛ | De.15, Ja.2, | 2.50 |
| **DIAMONDS, PLATINUM, ALUMINUM, VANADIUM, TIN** | | | | | | |
| De Beers Consol. | New York | ... | ... | 32½ | Ja.26, Ja.29 | 1.45 |
| So. Am. Gold & P. | N. Y. Curb | 3⅜ | 3⅛ | 3⅜ | ... | ... |
| Alum.Co.of Amer. | N.Y.Curb | 72⅝ | 72¼ | 72¼ | ... | ... |
| Alum. Co. of Amerpf. | N.Y.Curb | 102 | 102 | 102 | De.15, Ja.15 | Q 0.50 |
| Vanadium Corp. | New York | 42 | 39½ | 42 | Fe.1, Fe.15, | Q 0.75 |
| Patino M. & E. | N. Y. Curb | ... | ... | 25 | Ma.10, Ma.15 | 4 sh. |
| **ASBESTOS** | | | | | | |
| Asbestos Corp. | Montreal | 23 | 22⅞ | 22⅞ | Jan., 1926 | 1.50 |
| Asbestos Corp., pfd. | Montreal | 85 | 84½ | 84⅝ | De.31, Ja.15, | Q 1.75 |
| **SULPHUR** | | | | | | |
| Freeport Texas | New York | 46⅛ | 44⅛ | 45⅜ | Ja.15, Fe.1 | Q 0.50 |
| Texas Gulf, new | New York | 56¼ | 53⅜ | 55⅛ | Ma.1, Ma.15, | Q 1.00 |
| **MINING, SMELTING, REFINING AND GENERAL** | | | | | | |
| Amer. Metal | New York | 42½ | 41⅛ | 42⅛ | Fe.18, Ma. 1, | Q 0.75 |
| Amer. Metal pfd | New York | ... | ... | 109⅜ | Fe.19, Ma.1 | Q 1.75 |
| Amer. Sm. & Ref. | New York | 150⅛ | 143⅛ | 148 | Ja.14, Fe.1, | Q 2.00 |
| Amer. Sm.&Ref.pfd. | New York | ... | ... | 121⅜ | Fe.4, Ma.1, | Q 1.75 |
| Consol. M. & S. | Montreal | 245½ | 242 | 243 | De.31, Ja.15 | X 6.25 |
| Federated Metals | N. Y. Curb | ... | ... | 13⅜ | ... | ... |
| Newmont Mining | N. Y. Curb | 69⅜ | 68⅛ | 68⅛ | De.31, Ja.17, | 0.60 |
| U. S. Sm. R. & M. | New York | 36⅝ | 35 | 35⅜ | Ja.6, Ja.15, | Q 0.87½ |
| U. S. Sm. R.&M.pfd. | New York | 47⅛ | 46⅝ | 46⅝ | Ja.6, Ja.15, | Q 0.87½ |

* Cents per share. † Bid or asked. Q, Quarterly. SA, Semi-annually. M, Monthly. F, four weeks. I, Initial. X, Includes extra. The first date given is that of the closing of the books; the second that of the payment of the dividend.

Boston quotations courtesy Boston Stock Exchange; Toronto quotations those of the Standard Stock Exchange of Toronto, by courtesy of Arthur E. Moysey & Co.; Spokane, Pohlman Investment Co.; Salt Lake, J. A. Hogle & Co.; Colorado Springs, Colo., Henry Sachs

**LONDON QUOTATIONS—WEEK ENDED FEB. 15, 1927**

| Name | High | Low | Last | | Last Div. Date | Amount |
|---|---|---|---|---|---|---|
| Aramayo Mines (25 frs.) | 80/7½ | 78/6 | 80/— | Feb. | 1927 | 5 (†) |
| British Platinum (£1) | 3/6 | 3/— | 3/— | Feb. | 1925 | 2½ p.c. |
| Burma Corpn. (10 rupees) | 14/3 | 13/4½ | 14/— | Feb. | 1927 | 6 annas* |
| Bwana M'Kubwa (5s) | 6/4½ | 5/6 | 6/— | | | |
| Camp Bird (2s) | 4/1½ | 3/4½ | 3/6 | | | |
| El Ore (£1) | 5/— | 4/6 | 4/9 | Nov. | 1924 | 2½ p.c.* |
| Esperansa (10s) | —/2 | —/2 | —/2 | | | |
| Frontino & Bolivia (£1) | 13/9 | 11/3 | 13/9 | Jan. | 1927 | 5 p.c. |
| Mexican Corpn. (£1) | 10/9 | 10/— | 10/3 | | | |
| Mexico Mines of El Oro (£1) | 21/— | 16/3 | 16/3 | Dec. | 1926 | 3½ p.c.* |
| N'Changa Copper Mining | 17/3 | 16/3 | 16/10½ | | | |
| Oroville Dredging (£1) | 4/9 | 4/— | 4/9 | Dec. | 1923 | 3½ p.c. |
| Ouro Preto (£1) | 2/1½ | 2/— | 2/1½ | May | 1925 | 2½ p.c. |
| Rhodesian Congo Border (£1) | 81/3 | 75/— | 78/9 | | | |
| St. John del Rey (£1) | 12/9 | 10/10½ | 12/3 | June | 1925 | 6½ p.c. |
| San Francisco Mines (10s) | 30/9 | 29/7½ | 30/3 | Jan. | 1927 | 25s. |
| Santa Gertrudis (£1) | 16/4½ | 15/6 | 16/— | Jan. | 1927 | 3½ p.c. |
| Selukwe (2s. 6d.) | 10/6 | 10/1½ | 10/3 | April | 1917 | 6½ p.c. |
| S. Amer. Copper (2s.) | 3/4½ | 3/— | 3/3 | Nov. | 1917 | 75 p.c. |
| Tanganyika (£1) | 57/— | 43/9 | 46/10½ | Aug. | 1926 | 7½ p.c. |
| Tomboy (£1) | 3/6 | 3/1½ | 3/3 | July | 1926 | 10 p.c. |
| Union Miniere du Haut-Katanga (Brussels) | 8.900 | 8.750 | 8.750 | July | 1926 | 175 (‡) |

* Free of British income tax. † Swiss frs ‡ Belgian frs. and free of taxatio